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Methods Used in Assembling Sweepers

BY FRED H. COLVIN
Editor, *American Machinist*

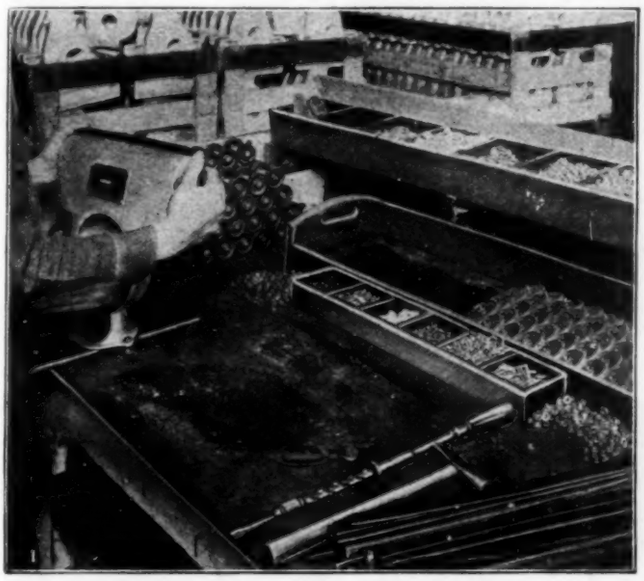
Layout of assembly departments with modern conveying apparatus—Running motors on assembly trucks—Securing co-operation by group bonus method

SOME OF THE methods used in the plant of the Hoover Suction Sweeper Company are of special interest and can well be adapted to other types of work. The spirit of co-operation between the members of the groups is very marked and has much to do with the results secured. This spirit is fostered by making the rewards of each member of a group dependent upon the output of the group as a whole, rather than on his own work alone, so that each man is always on the alert to see what he can do to help the output of his group rather than that of his own operation. This method is particularly useful where it is necessary to run a plant or a department with a skeleton force, as each member of a group can shift from one operation to another so as to keep the assembly moving through the department.

In Fig. 1 the furniture guard is being attached to the outside of the main casting or drum. The casters are also fastened on at this point. Then the brushes are mounted in place as in Fig. 2 and the driving belts put on. Next comes the motor with its fan assembly and the business end of the sweeper is fastened to the drum as in Fig. 3. In Fig. 4 the front casters are being inspected to see that the sweeper sets square on the block which is used to represent the floor it is to sweep.

Another view of the assembling department is shown in Fig. 5 and it will be noted that there are several benches on each side of a central bench, forming spaces or pockets for the different workers. This gives each man a separate compartment where he does his part as the sweepers pass down the center bench from one man to the next. From the last bench the sweepers are placed on the small trucks shown at *A*. These trucks have a socket into which the cord is plugged and, as the wheels of the truck make contact with an electric circuit, the motors get another running test as they pass down the line to the inspectors. As fast as these small trucks are emptied by the inspector at the other end they are placed on an incline and run back underneath as can be seen at *B*. The motors get a run of about 20 minutes as they pass down this line.

Fig. 6 shows a view of this line toward the other end. The small trucks with the motors running are seen in the foreground, also the track beneath on which the trucks return. The inspectors and testers are grouped along the conveyor system. As the machines are taken off the trucks they are placed on the conveying hooks seen in the background and go to the inspectors. When



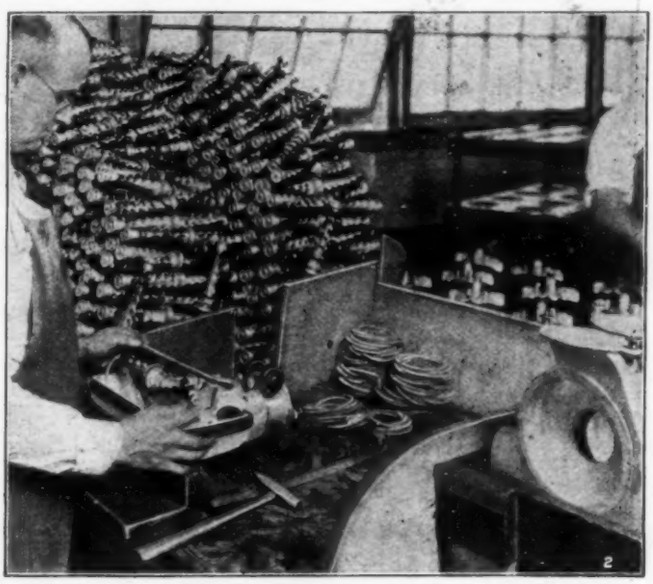


FIG. 1—PUTTING ON FURNITURE GUARDS. FIG. 2—INSERTING THE BRUSHES

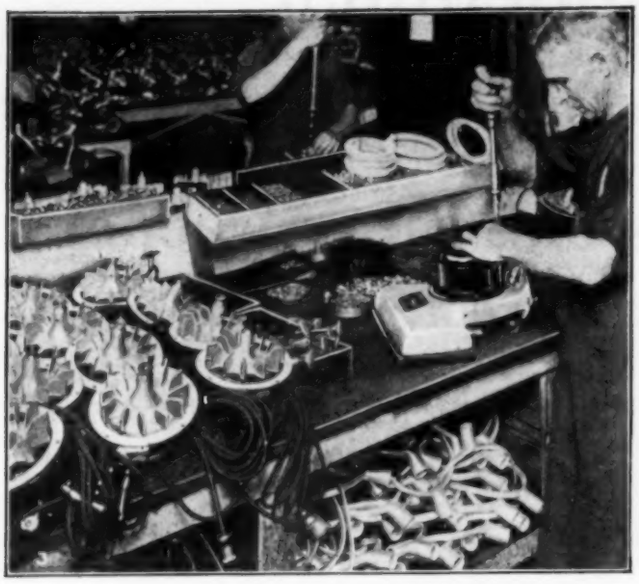


FIG. 3—MOUNTING THE MOTORS. FIG. 4—INSPECTING FOR SQUARENESS

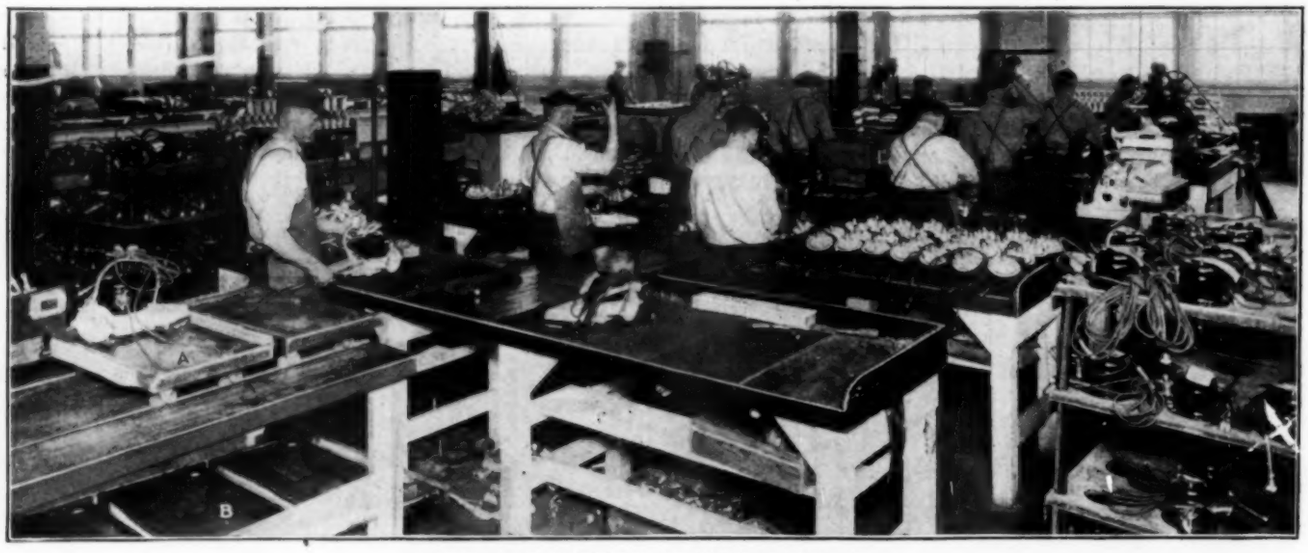


FIG. 5—A MODERN ASSEMBLY GROUP

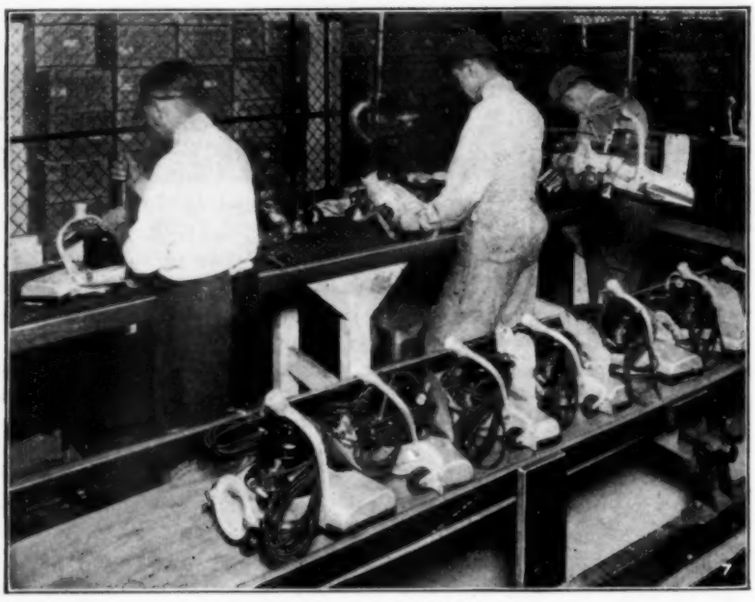


FIG. 6—THE INSPECTION CONVEYORS. FIG. 7—THE FINAL INSPECTORS

a sweeper is inspected, and adjusted if necessary, it is placed on a belt conveyor and the inspector lifts another sweeper from the hook nearest him. Whenever an empty hook passes the end of the truck line a machine is placed on and the truck sent to the assembling line.

A small group of final inspectors is shown in Fig. 7. The sweepers, which have already been inspected and tested, come to them on the belt conveyor in front. Each sweeper is taken off and checked by these men. If found defective in any way, a special tag is attached and the sweeper hung on one of the hook conveyors which passes their corner. If found O.K. it is placed on another belt conveyor which runs at right angles to the one in front and which carries the sweeper directly to the packing and shipping room. Hand trucking or carrying is almost non-existent in the whole plant.

A Problem in Epicyclic Gearing

By A. L. De Leeuw
Consulting Editor, *American Machinist*

A correspondent recently sent us the sketch shown herewith with a request to analyze this gear system for him. The writer believes that this same problem was solved and the solution given in an article written quite a number of years ago but, not being sure as to the date or the magazine in which it appeared, he could not refer the correspondent to it. Besides, it is only a poor kind of a solution when a man has to hunt up a magazine instead of sitting down and working the thing out for himself. The solution of this problem is perhaps a little more complicated than that of most problems of epicyclic gear trains but it is of the same nature. The same system of reasoning which we apply to the solution of this particular problem, will lead to the solution of any problem of this nature and, believing that this matter may be of some interest to the younger designers, we give it here with additional remarks.

The question is: If gear E makes 100 revolutions in the direction of arrow No. 1, how many revolutions will gear A make and in which direction? The original sketch gave the number of teeth of the various gears but we will not use them until we have developed a general formula. In all problems of this kind the main principle to apply is one well known in mechanics: A body which is at the same time subjected to more than one motion will, at the end of a certain time, arrive at a point where it would have arrived if it had been subjected first to one motion, then to the second, and then to the third, etc.

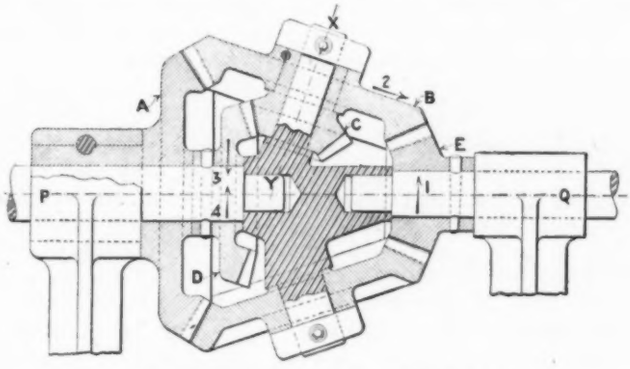
We must apply this principle because we see right away that there are some gears here which are subjected to more than one movement. The gears B and C, for instance, turn around the axis XY and also around the axis PQ. In order then to analyze the movement of these gears we must separate these two motions. If B made one revolution around axis PQ and if we forget for the present the fact that it also has some other movement, we will see at once that it takes the gear E with it. This movement of the gear B will cause E to rotate one revolution when B itself revolves once around the axis PQ.

When B travels around the horizontal axis, it is compelled to turn around the axis XY also, and that, by the fact that gear A is stationary. Whether gear B turns once around gear A, or whether B is stationary in relation to axis PQ, while A rotates one revolution makes no difference as to the effect on B in relation to axis XY. We will, therefore imagine that gear A rotates through one revolution. This causes gear B to move through $\frac{A}{B}$ revolutions and causes gear E to move through $\frac{A}{E}$ revolutions. In other words, B is merely an idler between A and E. We will assume that we have moved gear A, left hand, which causes gear B to move in the direction of arrow No. 2 and gear E in the direction of arrow No. 1.

We can see now that when gear B travels once around the horizontal axis PQ, it causes gear E to move one revolution and also $\frac{A}{E}$ revolutions or together $1 + \frac{A}{E} = \frac{E + A}{E}$ revolutions. From this then, we find that one revolution of E causes gear B to revolve $\frac{E}{E + A}$ revolutions around the horizontal axis PQ.

Gear E also causes gear B to move around the axis XY. The amount of this movement will be $\frac{E}{B}$ revolutions.

Having found how gears B and C are caused to move



AN EPICYCLIC TRAIN OF GEARS

if we turn gear E through one revolution, we must now find what effect this movement will have on gear D. In doing so we will again separate the two motions of gear C, namely, its movement around axis XY and that around axis PQ.

Considering the revolution of C around axis PQ, we find that it would cause gear B to also turn one revolution. As, gear C does not make one revolution around PQ but $\frac{E}{E + A}$ revolutions, gear D will also turn through that number of revolutions.

Furthermore one revolution of C around axis XY will cause gear D to move through $\frac{C}{D}$ revolutions.

As gear C does not move one revolution but $\frac{E}{B}$ revolutions, gear D will be made to move $\frac{E}{B} \times \frac{C}{D}$ revolutions so that the total number of revolutions of gear

$$D \text{ is } \pm \frac{E}{E + A} \pm \frac{C}{B} \frac{E}{D}.$$

The double sign for both terms of this formula is used because we do not know yet in which direction the axes are moving.

In the sketch gear E moves in the direction of arrow No. 1, causing gear B to revolve in the direction of arrow No. 2 around axis XY and from top toward bottom around the axis PQ, if we imagine the drawing to lie flat on the table. The rotation of gear B in the direction of arrow No. 2 causes gear D to move in the direction of arrow No. 3, while its movements around axis PQ causes gear D to move in the direction of arrow No. 4 so that we see that if one of the terms has the plus sign the other will have the negative sign. Furthermore, we see that if we call the direction of E right hand, the term $\frac{C}{B}\frac{E}{D}$ will also be right hand whereas the amount of rotation $\frac{E}{E+A}$ will be left hand.

In the problem as presented gear E has 21 teeth, B — 42, A — 48, C — 18 and D — 30, so that 100 revolutions of gear E would make $100 \times \left(\frac{21}{21+48} - \frac{18 \times 21}{42 \times 30}\right) = 100 \times \left(\frac{7}{23} - \frac{3}{10}\right) = 100 \times \frac{1}{230} = \frac{10}{23}$

We notice that there is an enormous reduction in speed, a reduction of 230 to 1. It can readily be seen that by changing the number of teeth in the various gears almost any reduction or increase of speed can be had. With the same number of teeth and without making the gears large, it will also be seen that a small change may reverse the direction of rotation.

An Example

If, for instance, gear C were made with 19 teeth instead of 18, leaving all other gears with the same number of teeth as at the present, we would have found that A makes $100 \times \left(\frac{21}{21+48} - \frac{19 \times 21}{42 \times 30}\right) = 100 \times \left(\frac{7}{23} - \frac{19}{60}\right) = 100 \times \left(-\frac{17}{1380}\right) = -\frac{170}{138}$.

The minus sign says that the gear A is now running in the opposite direction. We said that any reduction or increase of speed might be obtained. We should have said, that we can arrange the gears so that they would calculate a large increase of speed but one can readily see that if we should try to drive from A instead of from E the amount of friction which we would have to overcome would be sufficient to stall the apparatus.

We might imagine gear E to be a sleeve gear with the sleeve in the bearing and with a spur gear at the end of the sleeve. This spur gear in its turn might be driven from any other machine member. We can also imagine that gear A is not pinned to its bearing but that it has at the end of its hub another spur gear mounted which also is driven from some machine member. We can, as heretofore, imagine first, that gear A is stationary and E only running and then, that E is stationary and A is running. Either of these conditions would cause gear D to move at a certain speed and the total speed of this gear D will be the sum or the difference of the two speeds it would derive from E and A separately. We may call this arrangement the general arrangement of such a system of gearing. We will assume that gear E is caused to run n revolutions and gear A, N revolutions. Due to the first movement gear D will run $n \times \left(\frac{E}{E+A} - \frac{C}{B}\frac{E}{D}\right)$ whereas due to the movements of gear A this same gear D will be caused to run $N \times \left(\frac{A}{E+A} - \frac{A}{B}\frac{C}{D}\right)$ so that under the given conditions gear D will actually make $\pm n \times \left(\frac{E}{E+A} - \frac{C}{B}\frac{E}{D}\right) = \pm N \times \left(\frac{A}{E+A} - \frac{A}{B}\frac{C}{D}\right)$ revolutions.

The simplest modification of this system with which we are familiar is the so-called "jack in the box," where the gears A and E are equal and where C and D are missing. Applying the general formula to this arrangement we would find that B turns around the axis PQ one-half revolution for each revolution of E, if A is stationary or one-half revolution per revolution of A, if E is stationary and therefore that if both gears A and E are running, B will have a number of revolutions around axis PQ equal to half the sum or difference of the number of revolutions of A and E, depending on whether these two gears run in the same or opposite directions while the direction of gear B around the axis PQ will be always the same as that of the faster of the two gears A and E.

Such a "jack in the box" might be made with gears E and A of different sizes and some very pretty mechanical devices may be based on this mechanism.

Probably the reason why such mechanisms are not used more is that designers, fascinated by the possibility of the device, have tried to apply it under unfavorable conditions.

Some Special Welding Jobs

In the course of an address read before the International Acetylene Association Convention at Chicago last Fall, N. E. Wagner, Superintendent of Welding, Prairie Pipe Line Co., gave the following special uses for welding about the engine room and plant. The oxy-acetylene process has been used to good advantage in welding air lines. This company has been able to make neater jobs by welding on air lines, and has succeeded in eliminating leaks which are said to be frequent on air lines installed with screwed couplings and fittings.

Another item of importance in the pump and engine rooms on which they have accomplished a great saving, besides making a neater job, is guard railing over pumps, around flywheels and in similar situations. Their experience has been that such guards may be welded together from ordinary pipe, and that the result is a stronger and cheaper job than where threaded fittings are used.

They also employ the oxy-acetylene process in building stairs for work tanks at their station. The side railings and frames are welded together from old, second-hand pipe, and second-hand tank iron is used for the steps. All material used comes from the scrap pile. By welding the stairs in proper lengths and sizes, they have been able to install them at a very low cost compared with the cost of steel stairs as supplied by manufacturers. They are apparently giving perfect satisfaction.

Lubricating oil tanks of sizes ranging from 2½ to 12 bbl. capacity are also made up from scrap material. The material used is second-hand, 10 gauge smoke box iron scrapped from old steam plants which were dismantled after oil engines were installed. By cutting the iron into the desired sizes and passing the pieces through rolls to give them the proper curve, it was possible to weld up and complete the tanks at a very low cost. They are giving excellent service.

Normal Pitch as a Basic Factor in Computing Involute Gears

By ELLSWORTH SHELDON
New England Editor, *American Machinist*

A factor based upon parallelism of involutes—Does away with many complications—Takes account of profile errors as well as errors of spacing—Normal pitch is easy to measure

SINCE THAT remote day when some prehistoric mechanic first conceived the idea of putting pegs in the surface of a revolving cylinder for the purpose of transmitting power or motion from it to another cylinder similarly fitted with pegs, or having interstices with which the pegs of the first cylinder could mesh, the study of gear tooth forms has been one of absorbing interest and increasing importance to men whose duties or inclinations have led them into close contact with mechanical problems.

It is more than likely that this first primitive "gear designer" was so concerned with the difficulty of making his pegs of such shape that they would not be wrenched off by their change in angular position as they progressed through the arc of contact, that such considerations as "pitch diameters," "overlap," "backlash," "uniform angular velocity," etc., never occurred to his mind.

Though in succeeding years the application of toothed gearing had been extended to serve an infinite variety of purpose, and the form of a gear tooth had passed through many stages in its evolution from the crude peg to a symmetrical proportion that enabled it to perform its functions satisfactorily and without apparent effort, it was not until the introduction in the early part of the nineteenth century, of machinery for shaping the teeth of gears from the solid metal of the gear rim that the importance of details hitherto considered of little moment was appreciated, and the scientific study of gearing really begun.

The Epicycloidal or Double Curve Tooth

Though in the early years of the later period large powers were transmitted through toothed gearing, the speeds of individual units were relatively slow and space was not restricted to the extent of interfering with the ample proportioning of gear teeth. Stresses had not, therefore, nearly reached the ultimate strength of materials. Gears were noisy, but those who were associated with machinery had grown accustomed to the growl of heavy gears and the clatter of lighter ones until, if such noises were noticed at all, they were accepted as a necessary evil and were not looked upon as a waste of power or an agent of destruction.

Study of the action of gear teeth up to this time had led naturally to the development of the epicycloidal or double curve form of tooth. Mechanisms making use of gearing had been evolved that rendered the evil of varying angular velocity conspicuous, and the epicycloidal tooth is marvellously well adapted to correct it. Noise was believed to be almost wholly caused by backlash, and the epicycloidal tooth could be made with a minimum of backlash. Pitches were large, and the double curve tooth was not particularly difficult to produce in large sizes. Therefore it was but natural that when cut gearing came into vogue the epicycloidal tooth should be the form adopted.

Accuracy of Center Distances Essential

Epicycloidal gearing has one very serious fault. "Pitch line contact" is a condition vital to its action and center distances must, therefore, be accurately determined and rigidly maintained. Not only will such gears not run satisfactorily at other than mathematically correct center distances, but unless compensating errors are purposely introduced in their contour they will not run at all. Teeth will be broken out or distorted by wedging action even when little or no power is being transmitted.

Because of the more or less crude methods of measurements and lack of adequate means for securing interchangeability it was not easy to space center distances accurately, nor, because of the destructive agencies of wear and vibration, was it easy to maintain them when once they had been established. As the epicycloidal tooth positively refused duty under other conditions than extreme accuracy in this respect, experiments were made with other profiles. Probably the most important result of this study was the now well-known involute tooth, to which the matter of center distance is, within commercial limits, relatively unimportant.

Because of the rigid necessity for pitch line contact of gears with epicycloidal teeth, the "pitch circle" had become a basic factor in all computations of gearing. A hypothetical circle half-way between the actual outside diameter of the gear and the diameter of the same gear at the bottom of its teeth is supposed to represent the surface of a plain cylinder to roll against a like cylinder of the same or different diameter, which is the pitch circle of the mating gear.

"Circular pitch" is the distance from a given part of a tooth to the same part of the next tooth measured along the arc of this circle. "Chordal pitch" is the same distance measured in a straight line—the chord of this arc. "Diametral pitch" is a relation not a measurement, and is represented by the quotient of the number of teeth in a gear divided by the number of inches (and fractions of inches) in the pitch circle.

The "base circle" of an involute gear is the circle upon which are generated the involute curves that are the tooth profiles of the gear. "Pressure angle" is the

complement of an angle formed by the intersection of a line joining the centers of a pair of gears with a line tangent to the base circles of both. It is obvious that this angle is dependent upon the distance between centers at which the gears are to run, for if the latter were to be changed by advancing the gears into closer relation or by pulling them farther apart the tangent joining the two base circles would swing about its intersection with the center line and the angle would not be constant.

Normal Pitch

Because of the interdependence of all factors entering into the ordinary method of calculating gears and their relation to center distance, which is the one factor of a completed pair of gears that may be altered at will or by circumstance, there is coming into general use a factor that is even more basic than the pitch circle, and one about which all others may adjust themselves in accordance with any alteration of the center distance.

This factor is called "normal pitch," and is the distance in a straight line between adjacent involutes, measured along *any* line that is tangent to the base circle. It is also the distance between adjacent involutes measured along the arc of the base circle. It is in itself dependent upon the base circle and (for any given number of tests) upon nothing else. It disregards pitch diameters, diametral pitches, relative diameters of gears, pressure angles, and distances between centers. It may be said in general that any pair of gears having perfectly formed involute teeth *of the same normal pitch* will run quietly together regardless of all other conditions.

Demonstrating Normal Pitch

If we consider the usual method of demonstrating the involute curve, which method is the unwinding of a string from a cylinder placed upon end on the drawing board and allowing a pencil point at the end of the string to trace a line upon the paper as the string unwinds, we will observe that no matter from what point of the circle represented by the end of the cylinder the curve may start, all such curves must be parallel throughout their length. If, before winding the string upon the cylinder, we tie a series of knots in it, we will see that as the end of the string swings outward from the circle, each knot in turn as it rises from the circle will describe an involute of its own and that the distance between any two of these involutes, measured along the string must remain constant however far the string is unwound.

To whatever distance the string is unwound, it is always tangent to the cylinder. Wherever it may be it is always perpendicular (normal) to the curves at the point of intersection. Hence the term "normal pitch." If the knots in our string are to represent teeth in a gear it is obvious that they must be equidistantly spaced and the spacing must bear a definite alignment relation to the circumference of the cylinder or base circle, else we will have a hiatus in our gear teeth when the string had been unwound one full turn from the cylinder.

Thus, because of the necessity for having the number of teeth divide evenly into the circumference of the gear, the normal pitch must be an even division of the base circle. It follows, then, that the base circle diameter of mating gears will bear the same relation to each other as will the respective numbers of teeth, and also to the rotative speeds of the gears. Pitch diameters (and with them diametral pitches) have been discarded as factors of computation. Pressure angles are relative and may vary with the center distances.

A single involute gear cannot be said to have a pitch diameter. The pitch circles of two gears running together will pass through the actual point of contact of the opposed involutes and may vary in their diameters as the center distance is increased or diminished. The actual angle of pressure will vary as the common tangent of the two base circles swings about its intersection with the line joining the centers of the gears.

In earlier days, before micrometers had been evolved and the man who could measure to the "half of a sixty-fourth" was a skilled mechanic, a variation of a few thousandths of an inch in the thickness of a gear tooth was a matter of little concern. With the development of the science of "gearology" more accurate measurements became imperative and measuring instruments were developed by means of which the thickness and spacing of gear teeth could be determined within 0.001 in. With the evolution of the automobile, in the transmissions of which machine we regularly pass 50 hp. or more through gears that our forefathers would have considered about the right size for change gears on a 20-in. lathe, the thousandths became too great an error to be allowed and we are now obliged to measure in "tenths" if we desire quietly running gears.

It is easy for the mathematician to calculate the circular pitch of a gear; to *measure* it with any degree of accuracy is impossible. If we desire to measure the spacing of a completed gear for purposes of test or inspection, we must reduce circular to chordal pitch and take our measurements in a straight line. If we want to determine the thickness of a tooth we must split the circular pitch and calculate the chord of the split parts. In either case we must measure between "pitch points," and as these are hypothetical rather than actual locations upon a curved surface the resulting measurements are, to say the least, uncertain. Even if we succeed in obtaining accurate measurements, these take no account of a possible departure of the tooth profile from a true involute.

Normal Pitch Is Easy to Measure

In laying out gears by the normal pitch method we need consider only the base circle and the number of teeth. The normal pitch must be a factor that will divide evenly into the circumference of the base circle, the quotient being the number of teeth in the gear. Normal pitch may be measured in a straight line anywhere on the circumference of the gear, the only arbitrary requirement being that the line shall be tangent to the base circle. It disregards the length of the tooth and the gear need not, therefore, be finished upon its outer diameter, an important consideration in a hardened gear that is to be ground to diameter in a later operation.

Measuring the normal pitch of finished gears as a method of inspection is accomplished by the use of an instrument known as the "Odontometer," which device has a fixed and a movable jaw presenting parallel planes, both jaws facing in the same direction. It is applied by bringing the face of the fixed jaw into contact with one involute and so rocking the tool upon the periphery of the gear that the face of the movable jaw passes over the adjacent involute.

The measurement thus derived is the distance between the adjacent involutes in a straight line that is tangent to the base circle of the gear. The measure-

ment for inspection is comparative only and is registered upon a dial indicator. If arbitrary measurements are required, the movable jaw may be stopped at the moment of greatest amplification and a reading taken over the two jaws with a micrometer, from which reading is subtracted the known thickness of the movable jaw.

[The writer wishes to acknowledge his appreciation of the courtesy and co-operation extended to him by various members of the Pratt & Whitney engineering staff in the preparation of this article.]

Distributing Machine Tool Catalogs

By F. P. Terry

Most of our machine tool manufacturers expend a good deal of thought and money in producing catalogs and leaflets displaying their products, only to defeat their own ends by the overcautious manner of restricting distribution, or, on the other hand of distributing the catalogs where they will never be used or even see the light of day until carted away to the stokehole to aid in the production of steam.

Many firms do not hesitate to send out their catalogs to every established engineering works. These catalogs ultimately reach the buyer of the firm, but very rarely any further, except perhaps the publicity manager who is looking for tips to aid him in producing other catalogs. At the same time, machine tool firms must be aware that not more than one so-called buyer in a hundred has anything whatever to do with ordering machine tools beyond what any office boy could do, simply writing out the order.

The principal purpose of a catalog is to interest and whenever possible predispose the reader to favor the products therein, whether lathes or wheelbarrows. This interest cannot be developed too soon, even if the literature be handed to an apprentice boy just entering the machine shop, for the simple reason that later on that boy may be purchasing machine tools and it is quite natural that he should show a preference for the tools he knows all about.

Catalogs Sometimes Hard to Obtain

A few days ago I was asked by a young friend if I could get him two machine tool catalogs. He informed me that he had written both firms privately, and that one did not reply while the other offered to send a catalog on receipt of the name of his employers, through whom it would be sent. This young man is an under foreman in a machine shop which possesses both a foreman who thinks that machine tool catalogs should not interest his assistants, and also a manager who doesn't consult anyone regarding equipment because he knows it all. This enterprising young man is looking forward to the day when he can tell the manager that he doesn't know it all; and if I were a machine tool manufacturer, nothing would delight me better than that my catalog should aid him in his efforts, as I am sure he would have a preference for my products ever after.

Being in the position to get more catalogs than I want, I was able to oblige my friend with the desired ones, but the incident leaves him with a sort of grouch against the firms concerned. However high he may rise in his profession, it is doubtful if he will again ask for a catalog; and if he does it will certainly not have preference over any others that may come to hand, and an opportunity is lost which might have had far reaching effects for the two firms concerned. My own experience has proved this theory, as years ago I was very much in the same position as my young friend, and many catalogs that I first handled were rescued from the stokehole at the annual clear-out of the so-called buyer.

In discussing this matter with a machine tool manufacturer, it developed that he was quite sure that there was a better method of distribution than any in use at present and was anxious for my views, which I gave as follows:

In sending literature to firms I would plainly hint that the catalog is intended for the machine shop superintendent, and that any further copies required would be gladly sent. I would also send to every technical college and school, plainly stating that the catalog is for the use of the students, with the above proviso regarding further copies. I would also supply a copy to every plant's reading room.

In my advertisements I would include an application form for free copy; but as far as the *American Machinist* ads were concerned I would not ask for the firm's name, the fact that the applicant reads this journal being sufficient evidence of interest. In other cases, if the name of the firm were asked for, it would be plainly stated that the information would be treated as strictly confidential. If these methods were adopted some catalogs might go astray, but not as many as at present would be entirely lost.

Catalogs Should Be Freely Distributed

Most of our machine tool manufacturers seem to rely on the old maxim that "the world will beat a path to the door of the man who makes something better than ever made before," even though his works are located in the wilderness. There may be some truth in this maxim, but the beating process will be a slow one unless helped by advertising, and many wayfarers will be side-tracked from the path by the other fellows' more developed and better known methods of road making. The go-ahead manufacturer should know this fact; and to him it mattereth not if some seeds fall upon barren ground or among thorns, as he knows that they cannot be less fruitful than those which are stowed away in storerooms in his own works until such time as they become obsolete, or than the many which as before mentioned only serve to keep down some firm's coal bill.

Unnecessary Interruptions—Discussion

By William J. Fisher, Jr.

There was an interesting article under the above title by Frank V. Faulhaber on page 724, Vol. 57 of the *American Machinist* in which the writer condemns the practice of leaving an incomplete job to start a new one. Is there not another side to this?

In the shop where I am foreman, the orders come in marked "New Work" or "Emergency," and the latter are in nearly all cases given preference. The foreman must use his judgment and not the workman.

We always take a man off of new work to start and finish a new job, as to take a man off or regular work would not only cause loss of his time but loss of production as well, which is more important from a manufacturer's view. Of course time is charged on the emergency job from the time the workman leaves his first job until he returns.

Standardization in Austria

By James A. G. Pennington

In this article no attempt is made to go into details regarding standards, but rather to show what causes, both internal and external, led up to and are responsible for the change from a total lack of standardization to the well defined broad standardization now in progress.

Standardization as understood in the United States did not exist in Austria before the war, but times have changed even in Austria in this respect. The demand for certain war materials in enormous quantities forced the industries affected to standardize their production methods and this gave the initial impulse to a general standardization in Austrian industries.

American competition, which is bound to return with increased force, has also been a deciding factor in promoting standards both in parts, units, measurements and dimensions as well as in aggregates and complete assemblies. Since the partition of the empire, Austrian industries have become largely dependent on exports to keep their factories running to capacity. They now have tariffs confronting them in a large section of their former sales territory which they have to overcome the same as any other foreign industry. Furthermore such countries as Bulgaria, Roumania and other Near East nations depended in large degree on Austria for their manufactured goods in the past. Now, however, they are anxious to develop industries of their own. Today many Austrian industries are able to meet all comers in their old sales territory for two reasons. Their labor costs, figured on a gold basis, are lower than that of any other country, and they have, in many cases, assembling plants scattered throughout this territory. Still it is conceded that the present advantages are only temporary and that sooner or later United States and native competition will have to be met in earnest.

Progress of Standardization

In 1921 a standardization, or normalizing committee, representing the various industries was established, but so far most of its work has not progressed beyond the paper stage. The automotive and electrical industries have done a good deal of standardizing on their own initiative and the beneficial results obtained have created a deep impression on the other Austrian industries. The Central Standardization Committee is meeting with the same difficulties that the German committee had to contend with. Threads, bolts, nuts, shafting, etc. exist in all conceivable types and sizes. In the past not only each industry, but almost each factory had its own set of standards, which were changed from time to time. However, as nothing was ever discarded as obsolete, the manufacturer often had to furnish spare parts for machines fifty or more years old. Even on the railroads locomotives built in 1869 are still in operation, although not a single unit of that type has remained unaltered in the present day locomotives. Obsolescence has only occurred where electricity or oil has displaced older equipment. Another obstacle to the standardization of types or sizes of manufactured goods has been the willingness of manufacturers to meet the whims and desires of individual purchasers. To illustrate the point in question it might be mentioned that one of the large steel plants (Bleckman Steel Works) visited was still making over 200 different types of files and found it necessary to make a different kind of anvil for each country.

With all these difficulties to meet, the Standardization Committee is making slow progress, but the Whitworth thread and standards for bolts and nuts have been adopted as a preliminary. Since German and Austrian factories often have close working agreements it is likely that standardization will follow similar lines to that in Germany. At least in the machine tool industry this is apt to be the case.

The automotive industry is almost as well standardized as in the United States. Austria has both large and small plants, the largest being the Steyr Works which have a yearly output of fifteen thousand cars. This concern has standardized the various units of its cars as well as the chassis and bodies. All parts are interchangeable and the plan of manufacture is similar to that of one of the large United States motor-car plants. Other factories have standardized on parts, units, measurements and dimensions as well as types of chassis and bodies. This has been both necessary and possible through their large export business.

Another industry which has taken a great step forward in the direction of standardization is the electrical. Motors, generators, fuses, wire cables, motor car- and train-lighting systems have been standardized as to sizes and types. Only large turbogenerators and similar equipment are built according to customers specifications. Even the new electric locomotives for the Austrian federal railways have been standardized, although three different firms are building them. The reason for this advanced standardization is the tremendous impetus given the electrical industry in Austria since the close of the war. According to an old proverb: "It is an ill wind that blows nobody good" and that is true of the coal shortage in Austria. Hydro-electric power is displacing steam or steam-electric power on all sides, whether it be to operate some farm equipment, a factory, rolling mill or railroad train. Thus it has been possible to standardize measurements, types and sizes of all electrical equipment and manufacture on a quantity basis.

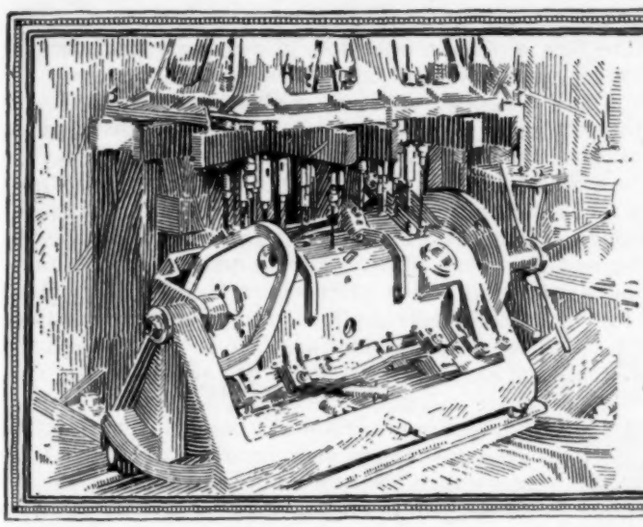
In this connection it is interesting to note that the best machine tools in use in Austria today are of American make. There are few automatics of any make in operation, but there should be a limited market for automatic and semi-automatic machinery suitable for the automotive and electrical industries, in spite of the low value of the Austrian currency.

Consumption of Electricity by Industries

An article in a recent issue of *Electrical World* shows graphically the consumption of electricity by industries. It is shown that the iron and steel industry with 832 plants, each using over 500,000 kw.-hr. per annum, consumed in 1920 8,115,000,000 kw.-hr.

Metals and metal products used over 500,000 kw.-hr. per annum in each of 424 plants.

In order to permit comparison, observe in other industries the number of plants using over 500,000 kw.-hr. per annum. Food, 723; textile, 720; stone and clay and their products, 534; paper and printing, 425; lumber, 326. The horsepower of installed motors is: Iron and steel, 4,956,405; mines, quarries and wells, 2,890,046; chemicals and allied products, 2,197,868; textiles, 1,680,797; food, 1,448,706; paper and printing, 1,037,541; stone and clay and their products, 788,628.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Design of drawing dies continued—Diameter of blank required—Arrangement of pressure pads and ejectors—Work requiring several drawing operations

THE material from which the work is to be drawn and the general shape of the blank are important in determining the diameter of blank required for a drawing operation. Fig. 495 gives a number of formulas for determining blank diameters for shaping various forms of work. These formulas must be considered as only approximating the size, and accurate results cannot be absolutely determined by the formulas. There are cases when excellent results may be obtained by using mathematics to figure the size of the blank, but the only absolute method which can be relied upon is by means of experiment.

Were it not for the fact that the stretch of the metal is not always uniform, formulas could doubtless be devised which would give accurate results; but as the stretch has not been considered in the formulas, they must be considered as approximate only. A careful study of the data given here will enable a man to form a very good idea of the approximate relation of the blank to the finished work, and will as a consequence enable him to proportion his die so that it will approach very closely to the completed die.

Methods of Attaching Pressure Pads

There are many ways in which pressure pads can be attached to dies. The simplest of these is by locating springs directly under the pads and limiting the movement by means of screws. There are cases, however, when a great amount of spring is required, and then it is often necessary to locate very heavy coil springs under the bolster of the press; in such cases the method employed is somewhat different. Fig. 496 shows several methods of attaching pressure pads. The example given at *A* shows at *B* a pad or ring mounted in the die *C*. Two pressure pins *D* are fitted into the die in such a way that they go through the bolster and locate against a special plate *E* which may be termed a pressure plate. This plate is held in place by two bolts *F*, on which are coil springs *G* which are utilized to apply the necessary degree of pressure. Adjustment is made by the nuts *H*, which are screwed up or down according to the amount of pressure required.

When irregular work is to be formed, two pressure pads employing different degrees of spring pressures may often be required, and when this is the case a special arrangement must be made. An example of this kind is shown at *K* in which there are two pressure pads, *L* and *M*, located in the die *N*. The pressure pins which are used in this case are similar to those shown previously at *A*, except that the pins thrust against different plates and each plate is independent of the other. Various arrangements of plates and pins can be made, according to the nature of the work, its

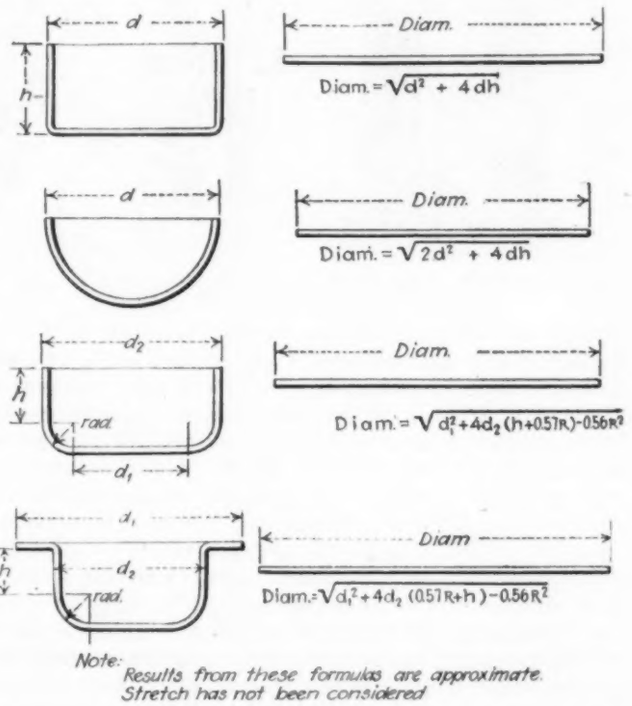


FIG. 495—FORMULAS FOR DETERMINING DIAMETER OF BLANK FOR DRAWING

diameter and general requirements. The number of pressure pins used should be such as to distribute the pressure in uniform manner on the pads.

Another arrangement, shown at *O*, uses a rubber cushion instead of springs. The plate *Q* is permanently located in position, and as pressure is applied through

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the pins *R* the rubber cushion is compressed so that the pressure resulting is sufficient for the work being handled. One of the objections to the use of rubber for pads of this sort is that it is not impervious to oil; and as oil is likely to come in contact with it, it will be seen that the life of the rubber will be materially shortened.

Another objection to the use of rubber is the fact that it is not good for long movements, because it is likely to buckle, thus decreasing its strength and causing trouble. An example to show how a condition of this kind would affect a rubber cushion is given at *S*. A method which can be used to prevent trouble of this nature to some extent is shown at *T*. A tube *U* is placed around the rubber to act as a guard and prevent it from springing too badly out of shape. The function of this tube and its operation will be readily understood.

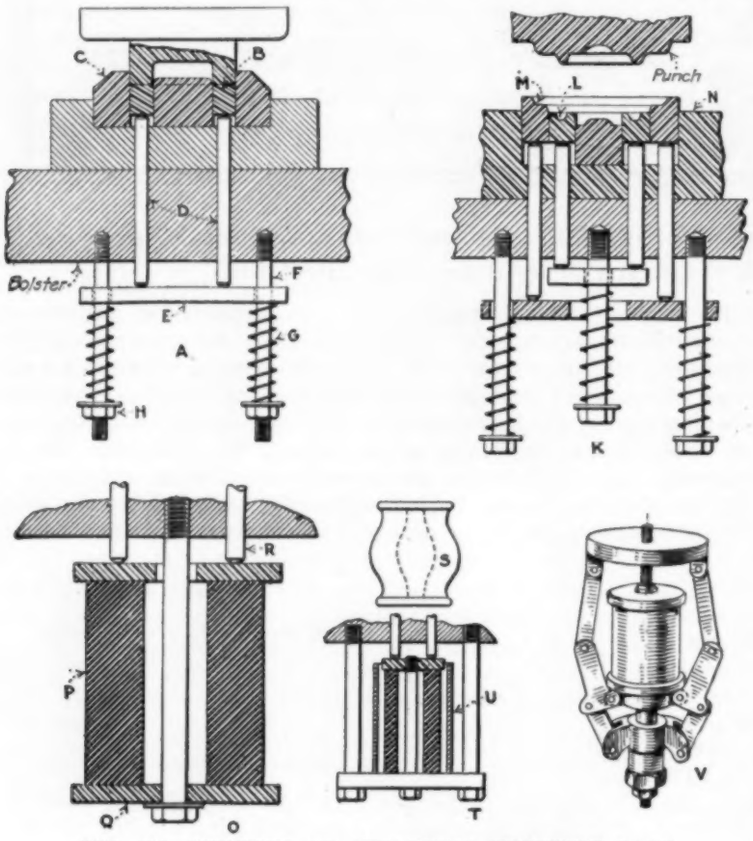


FIG. 496—METHODS OF ATTACHING PRESSURE PADS

In addition to springs and rubber, an air cushion is also used as a means of applying pressure to pressure rings or pressure pads. In the example *V* is shown a pressure attachment for this purpose which has recently been developed for drawing and other types of dies. An attachment of this sort tends to eliminate accumulated spring pressures and make them more uniform. It also reduces compression and saves power; uniform pressure for the entire drawing operation is much more easily obtained, and the work produced is generally considerably better than when spring pads are used.

An additional advantage claimed for this attachment is that breakage is very materially reduced. By means of an attachment of this kind shells can be drawn considerably deeper than by any means heretofore employed, and by means of combination and reducing dies certain classes of work can be done which formerly required the use of double-action dies. The application of an attachment of this kind to the machine does not interfere with the operator in the least nor does it hinder the rapid removal of dies.

There are other devices on the market designed to take the place of pressure pads. One of these operates by means of a toggle which is permanently attached to a single-action press in such a way that it produces a pressure on the blank which decreases during the downward stroke of the ram. In order to attain the highest degree of efficiency in the production of drawn metal parts, an action of this sort is essential. These attachments are made in various sizes suitable for work of wide range.

Types of Ejectors

We have mentioned the fact that ejectors are necessary in drawing dies to throw out the work from the die and also eject it from the punch. If an ejector were not used it would be necessary for the operator to stop the press and knock or pry the work away from either the punch or the die. Fig. 497 shows several types of ejectors used on drawing dies. The example at *A* is a die for drawing the cup-shaped piece indicated at *B*. A pressure ring *C* is used in this die, and is so arranged as to eject the work from the forming block *D* while the knock-out plunger or ejector *E* sheds the work from the punch *F*. This ejector operates automatically and the pressure is applied by means of the spring *G*, the movement being limited by the collar shown at *H*.

The example *K* shows a die for drawing the work *L*, which is a portion of a sphere. The forming die-ring *M* is mounted on the die-block and overhangs the hole as shown. Due to the fact that the work has a certain amount of spring in it, it will naturally open out after the punch has carried through the die. Thus on the return stroke of the punch the work will strike the under side of the die-ring, thus shedding the work from the punch and allowing it to drop down through the die as indicated by the dotted lines at *N*.

There are some cases where the work does not spring, and there will be a tendency on the part of the work to cling to the punch and follow it up. For work like this an ejector is necessary, and something on the order of that shown at *O* might be used. In this case the ejector is of the spring-plunger type in which the plug *P* is beveled on the upper side, so that it is forced back as the work passes by it on the downward stroke of the press. After the work has passed it the plunger strikes against the lower portion of the punch as shown in the illustration, so that as it is withdrawn the edge of the work catches on the ejector and is pulled off from the punch. The diagram at *Q* shows the manner in which this type of ejector operates.

A diagram shown at *R* illustrates a very simple method of ejecting work. The ejector shown here is operated by means of the punch holder *S*. To this holder a plate is attached at *U* by means of two studs *V*. This plate carries the ejector *T*, which is screwed into it in such a way that it can be easily adjusted. The action of this mechanism is as follows: As the punch descends in drawing the work the entire mechanism is carried down with it; and on the upward stroke as the punch is raised from the die after the work has

been formed, the ejector is also moved upward so that it strikes the under side of the piece and forces it out of the die. This is a very simple type of ejector, the application of which can be made to many forms of work.

Work Requiring Several Drawing Operations

When deep drawing operations are required it is necessary to produce the various depths by means of successive operations, and the greatest care is necessary to avoid tearing or breaking the metal by attempting to do too much at one time. Fig. 498 shows a very good example at *A* of a piece of work which requires several drawing operations in order to bring it to the required form. At *B* is shown the blank from which the work is produced. If an attempt were made to draw this piece of work in one operation the result would undoubtedly be like that shown at *C*, as the punch *D* is of such shape that it would have a tendency to tear and pierce the stock, as indicated in the illustration. For this reason it would be better to lay out the dies so that the first operation would be a combination blanking and drawing die of a form somewhat similar to that shown in Fig. 494 in the previous article.

After the first draw has been performed, it can be followed by a die like that shown at *E*. Here the work fits over the forming ring *F*, which is made of suitable size to fit the diameter drawn in the first operation. The die *G* passes down on the work and draws it over the plug *H*. The forming ring *F* also acts as an ejector and is a sliding fit on the plug *H*. The latter has an air hole in it as shown, as something of this sort is necessary.

In the next operation the form is developed somewhat

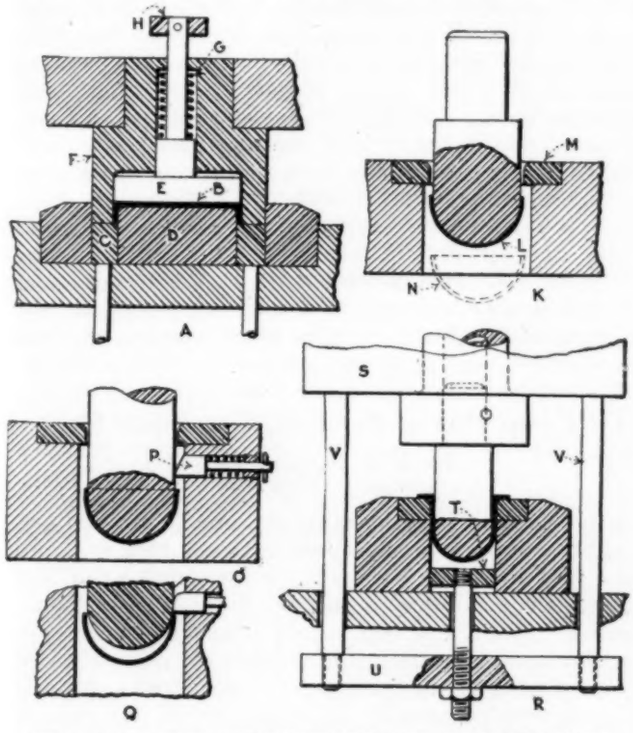


FIG. 497—TYPES OF EJECTORS FOR DRAWN WORK

more into a conical shape, and the work is semi-formed preparatory to the next draw. We have not illustrated this particular die as it seems unnecessary. In the example shown at *K* the third drawing operation is indicated in its completed form and the method of drawing the work to the smaller diameter is clearly shown. The die construction in general is similar to that shown at *E*, except that the work is not drawn down to a single diameter but is formed as indicated by the heavy outline of the piece.

The fourth operation is similar to the third, the work being drawn into the shape *L*. After this has been done the work is dropped into the die *M* and struck by the punch *N*. This operation does not require any spring pads, as it is simply a sizing operation. The

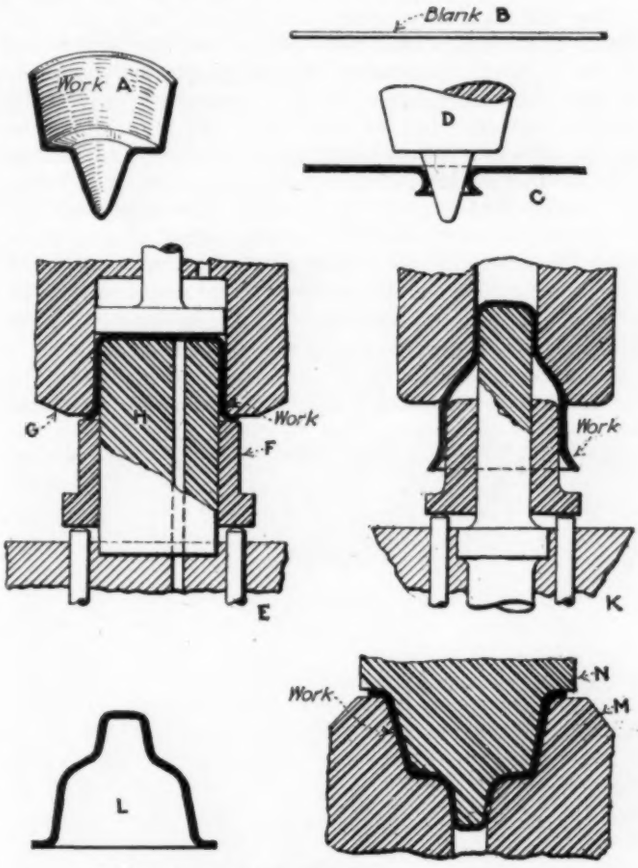


FIG. 498—PRODUCING WORK IN SEVERAL DRAWING OPERATIONS

conical point has not been completed in this operation, but everything except this point has been formed. In the next operation the point would be made, after which the work is trimmed, which is the final operation. It is possible to trim the work and form the conical point in the same die if desired.

Experience and Fundamentals Necessary

This example may be considered as a representative piece of work which the designer will do well to study with care. It must be remembered that for work of this character experience is an important factor; yet if the novice goes at it systematically and gathers all the information on the subject that he can obtain, he will soon reach a point where he will understand the limitations of the various drawing operations and will be able to proportion these operations so that he will obtain excellent results. The more work of this kind is done the more proficient the designer will become, particularly if he takes an interest in it and tries conscientiously to understand the fundamental principles involved in the drawing process. After the principles have been grasped, the details can be readily worked out.

Insuring the Mortgagee's Interest

In a report recently issued by the Chamber of Commerce the statement is made that 60 per cent of the realty in this country is encumbered to a greater or less extent by mortgages. Those lending money on such mortgages naturally desire that buildings on the real estate be adequately protected against loss by fire. Furthermore, they desire proper protection of their interest in the fire insurance policy issued on these buildings.

The fire insurance policy is a contract with an individual and certain actions or neglect on his part would render it void. Inasmuch as the person to whom the property is mortgaged cannot generally control the owner's actions, his security for the loan would be vitally affected if his right to recover was subject to acts of the owner which might invalidate the policy. It is important that the mortgagee have adequate protection. For these reasons, certain forms of protection more liberal than the owner himself could reasonably expect have been devised to meet the mortgagee's needs.

Many larger institutions dealing in mortgages in great numbers provide for insurance on them under a blanket agreement with an insurance company. The terms of such contracts follow very generally the standard mortgagee rider. The business man or average investor does not usually handle enough mortgages to warrant such a contract. There are, however, four other methods by which he may protect his interest.

The Four Methods Outlined

The mortgagee may obtain a separate policy covering his own interest. Under this, the owner has, of course, no rights. In case a loss is paid, rights under the mortgage for the amount paid are transferred to and collected by the insurance company from the owner at maturity. The owner is in no way worse off than if this claim against him had not been transferred to the insurance company, for if he does not have any insurance he will have to bear the fire loss himself anyway, as well as pay the mortgage. The advantage of a separate policy is that the mortgagee can select his own insurer if he is dissatisfied with the company in which the owner is covered. A disadvantage, however, is that the mortgagee must place the insurance and keep it in force. A separate policy to safeguard the mortgagee's interest is seldom used.

Another method by which the mortgagee's interest may be protected is by assignment of the owner's policy. Such assignment must be consented to by the company. This plan is disadvantageous in that the insured can receive no better title to the policy than the owner possesses. Thus, if the policy is void to the owner at the time of assignment because of any previous act, it is void to the mortgagee, for he obtains no better rights. Further, if after the assignment, the owner commits any act rendering the policy void, it also becomes invalid as to the mortgagee. Although any defenses good against the owner are likewise valid against the mortgagee, the latter does not have all of the rights of the owner, for he possesses no legal status in relation to the policy.

The protection of the mortgagee's interest is sometimes affected by the insertion of what is known as the short form of the "Loss Payable Clause."

In other states, however, the interpretation of this clause is not so favorable to the mortgagee since he is held to be an appointee or representative of the insured to receive the insurance money. Under such a ruling, any defenses valid against the owner would necessarily be good against him. Furthermore, as he is not a party to the contract, he is in much the same situation as the assignee above referred to, who must submit to all awards for settlement which may be agreed to by the owner and the insurance company.

Standard Mortgagee Clause

The latter interpretation of the "Loss Payable Clause" led to the use of a clause more liberal to the mortgagee, known as the "Standard Mortgagee Clause." Its principal provisions are:

(a) That the interest of the mortgagee shall not be invalidated by any act or neglect of the owner, foreclosure, proceedings of sale, changes in title or ownership, nor by occupation for purposes more hazardous than permitted. On the other hand, the mortgagee must pay the premium for the policy on demand, if the owner neglects to do so.

(b) The mortgagee must notify the company of change in ownership, occupancy or hazard, and pay any increased premium for same. He cannot, however, be presumed to have knowledge of all changes.

(c) The company reserves the right to cancel the policy, but must give ten days' notice to the mortgagee before its liability shall cease to him.

(d) If the owner has violated the policy provisions without the mortgagee's knowledge, we have seen that the policy is void as to the owner but not as to the mortgagee. However, the insurance company, upon paying the mortgagee's claim, is entitled to have transferred to it the rights of the mortgages for the amount paid. It can then collect from the owner when the mortgage becomes due, but the claim which it has thus acquired may not prejudice any remaining claim which the mortgagee has against the owner.

Except in states where the courts have given exceptionally favorable interpretation to the "Loss Payable Clause," the standard clause furnishes the best type of protection for the mortgagee. Even its liberality varies in different states depending on their legal interpretations. For instance, in some states the application of this clause relieves the mortgagee only from liability for neglect of the owner occurring subsequent to its use, while in other states it relieves him from all liability, whether occurring, subsequent or prior to the date of its use. In no case, however, is the mortgagee's interest protected, if at the inception of the contract, or the attachment of the clause, he did not disclose any facts which he knew would render the entire policy void as to the insured.

To Keep Out of the Rut, Use Your Eyes

By J. R. Cavanaugh
Toolmaker and Designer

Why is it that so many of us get into the rut and new men have to come in and show us things that we know but do not see? We work with our eyes shut. Our way to get out the work we believe to be the best way possible. But a new man comes along and bang!—out come automatic machines and simple fixtures, production is increased, and the new man is considered a wonder. He is a wonder, because he makes use of his eyes as well as his brains.

Pick out a problem and think of it outside of your job. How can I increase the production at less cost? Or hold the present production at less cost? The new man would see the way, so see it yourself, and it won't be long before you are off the bench as a result of doing just such a simple thing as using your eyes.

Management Methods and Principles of Frank B. Gilbreth, Inc.—II

By K. H. CONDIT
Editor, *American Machinist*

Plant survey first step in reorganization—Use of stereoscopic camera—Collecting blank forms, written orders and blueprints Disposition of useless material—Process charts

THERE IS NOT much use in trying to mend a tire until you know where the tack went through. By the same token, little is likely to be accomplished in the way of improving shop methods if the improver is unfamiliar with the methods in use in that shop. Many a so-called efficiency engineer has come to grief through failure to grasp this fundamental fact and has thereby added to the feeling of distrust that exists toward his profession.

How, then, is the best and quickest way to ascertain existing conditions and record them? Probably the most useful tool for this job is the photographic camera. The Gilbreths and their engineers use a stereoscopic camera taking negatives 45x107 mm. in size. They have found it possible to enlarge these up to 40 in. high where necessary.

One reason for using stereoscopic photographs is that they give a much better idea of the subject because of the three-dimensional effect which is absent in an ordinary print. Experience has proved their worth many times and shown them to be second in value only to actual presence on the ground. The contrast is particularly sharp when the camera is at one end of a battery of similar machines.

Lantern Slides for Talks

Another important reason for using stereoscopic pictures in the size mentioned and making the size a standard, is that lantern slides are prepared from them for use in a projecting lantern to illustrate conferences with executives and foremen. An office showing is the subject of Fig. 1 and a shop group appears in Fig. 2. Prints from the same negatives are also prepared to be lent to foremen or workmen together with an inexpensive stereoscope, so that they can be taken home and studied in the evening.

Susprising results have been obtained from this simple method of arousing interest for it gets a man in spite of himself, especially if he is seeing stereoscopic pictures for the first time. No matter how suspicious he may be of the "expert" he can hardly refuse the friendly offer of the stereoscope and the prints, and once he has started to look at them he is well on the way to conversion into an enthusiastic co-operator whose suggestions for improvements in method and detail are invaluable.

The main purpose of the photographs is to obtain an accurate record of existing conditions exactly as they are and not as men think they are. Close contact with work and the consequent familiarity with its details dull the critical perceptions of the men engaged in it and make it almost impossible for them to give a true description in words. As a matter of fact when they see themselves and what they have been doing, as the camera sees them, they are usually moved to laughter. When this happens in the executives' theatre, or whatever else you may choose to call the place where you get the foremen or other executives together to talk things over, considerable tact is demanded of the engineer showing the slides. He must immediately point out the good features of the method in question or

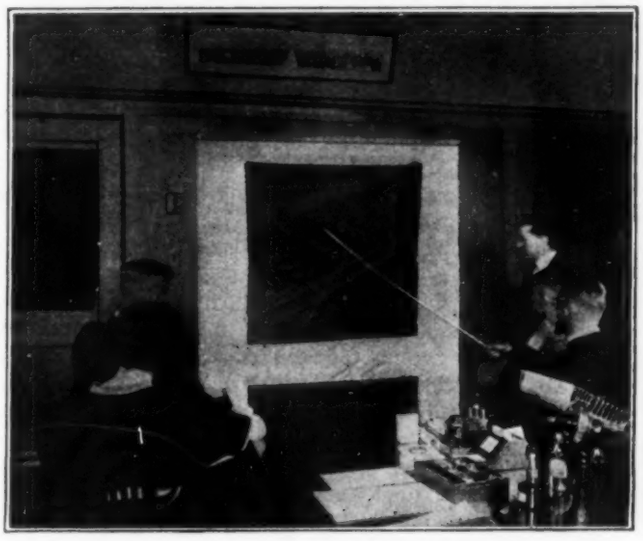


FIG. 1—AN OFFICE GROUP LOOKING AT MOTION PICTURES OF THEIR WORK

somebody's feelings are likely to suffer, and much harm may result.

To get the right kind of record it is better to have the engineer take his own photographs. If a commercial photographer takes them they are almost sure to be posed and consequently of little use as evidences of actual practice. The engineer knows what he wants to record. He is after the bad features as well as the good ones so that he will know what to avoid as well as what to keep. In addition he wants to have incontestable records of the exact way in which a given operation is performed before he touches it, during the transition period and after he has done the best he can to improve it. Such records are of value to prove what was actually accomplished on this particular job and as reference data when similar jobs are undertaken in future.

Another sort of photograph that produces surprising results is the "dark corner" photograph taken with the

aid of flash powder. Try it on your own shop or office and see what you will find in the dark corner under the bench or desk or behind the door which stands wide open continuously. One automobile company found an experimental type of steering wheel that had been lying under a draftsman's table for four years simply because nobody had thought about it and because it had no particular destination. Things unearthed in this way merit the designation of dirt, if we accept an old definition of dirt as "material out of place."

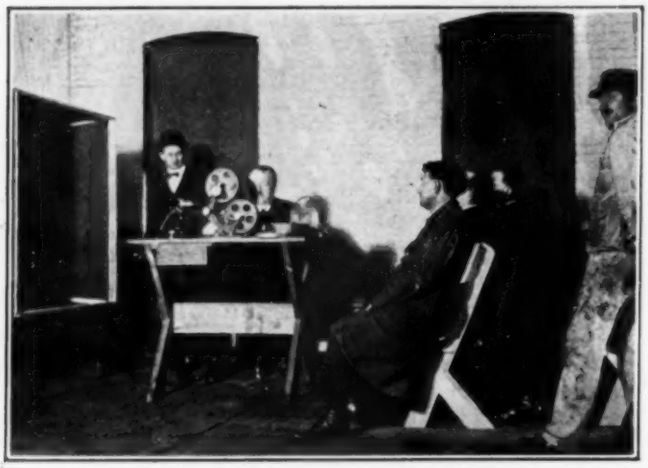


FIG. 2—SHOP GROUP WATCHING THEMSELVES IN ACTION

To sum up, the uses of the photographs are as follows:

1. To assist in planning (stereoscopic effect here is very valuable).
2. When enlarged to make exhibits, advertisements, etc.
3. To be shown as lantern slides in the executive's theatre.
4. To identify the method of timed operations (a special clock is placed beside the machine or operator and included in the photograph).
5. To be loaned with a stereoscope to foremen or operatives.
6. To illustrate papers for scientific societies.
7. With the three-position promotion plan to show beginners how the old-timers do it.

Blank Forms

Another method of ascertaining existing conditions in a plant is to collect all blank forms, current and obsolete, and go over them to get the history of their development. There must have been some reason, however obscure, for the printing of each one and when all the reasons have been dug out, if this is at all possible, the investigator has a fair idea of the organization of the business.

In going over the forms used in any plant it is surprising to find how very few good ones there are. If you have no compunctions about the feelings of the manager ask him to produce one form that is entirely satisfactory as it stands. Incidentally, it may be illuminating to apply this test to your own forms.

All sorts of different sizes will usually be found, many of which will not fit a typewriter or any ordinary filing case. Often no attention has been given to the question of making the form easy to fill out and consequently important items may be overlooked or neglected. The rulings are usually just the wrong distance apart to fit any typewriter, accounting or billing machine and the work has to be spaced by hand, a proceeding which gives a sloppy, uneven look to the page.

In most cases little thought has been given to the kind of paper used. This factor naturally varies with the writing medium, pen, pencil or typewriter and need for durability. There are few things more annoying than to write with ink on a soft paper that is apparently closely related to a blotter judging from the way the ink spreads and the pen picks up fibers. Many of the men who have to fill out forms have enough other things to try their patience without adding this one.

Another failing of the blank form is the arrangement of the ruling so that when the form is bound up with other similar ones part of the significant information is hidden by the binding.

Written Orders and Blueprints Collected

In addition to collecting forms the investigator should get copies of all blueprints, current and obsolete, and also a complete file of all written orders which govern the conduct of the business. This may sound easy but as a matter of fact it is a physical impossibility so far as the orders are concerned. Certain methods or processes will be found in every plant which exist for no discoverable reason and persist like legends. In some cases they are satisfactory, in others they are good subjects for improvement or elimination. For purposes of record the best that can be done is to reduce them to writing just as they are being practised, including with the record, if possible, photographs to amplify the text.

The natural result of digging out blank forms and other papers of all ages is the uncovering of a large amount of paper that should be destroyed as worthless. The Gilbreth way of handling such accumulations is to sort them into piles, tie each pile up and mark it with what they call a destruction label. In Fig. 3 is shown a typical destruction label. The purpose of the label is to insure the destruction at some future date of worthless matter that it may not be desirable to destroy at once. The arrangement of the label is self-explanatory. A destruction register is used to keep track of the various parcels to be disposed of.

DESTRUCTION LABEL

THIS PACKAGE IS NO. 998 AND CONTAINS ONLY

_____

DATED FROM _____ 19____ TO _____ 19____

WE HAVE CHECKED ITS CONTENTS.

SIGN HERE _____ BASKET NUMBER _____

SIGN HERE _____ BASKET NUMBER _____

THIS PACKAGE IS TO BE DISPOSED OF BY _____ (HOW)

ON _____ (DATE) 19____ _____ (DATE) (STAMP)

SIGN HERE _____

EXECUTIVE AS DESIGNATED IN STANDING ORDERS

FORM 1001

FIG. 3—FORM USED TO DESIGNATE OLD FORMS OR OTHER MATERIAL OF NO FURTHER USE

It should be noted that once a package is tied up and marked with a destruction label it is not opened again. The decision as to the worthlessness of the contents is

made at the time the package is tied up and the instructions on the label are to the effect that the package is to be destroyed without opening at some future date.

Another useful tool for recording the results of the plant survey is the process chart which is referred to by the Gilbreths as the first step in finding the one best

FIG. 4—PROCESS CHARTS HUNG IN AN EXECUTIVE'S OFFICE

way to do work. It was described in a paper presented at the annual meeting of the American Society of Mechanical Engineers in 1921 and may be found in the transactions of the Society. Its place in the investigation scheme was shown in an earlier article. Its construction and use will be taken up here.

Many a manager has found himself irritated and often baffled by his inability to visualize the whole process under his direction. As a result he has had to make decisions based on incomplete knowledge that are sometimes little better than guesses and may be disastrous. The process chart is a sort of stenographic movie that fills this gap. It can be applied to any kind of process in any kind of shop or office and, as used by the Gilbreths, can be made a most effective salesman.

One of the best features of the process chart is that it affords a means of putting the existing methods on paper, locating the spots that need improvement, making the improvement and comparing the new method with the old, before a single change need be made in the plant itself. The time may not be ripe for even the smallest disturbance in present methods although waste and inefficiency may be glaringly evident. By means of the process chart the changes can all be planned and then put into effect when business slackens or some emergency arises which makes the change desirable.

Qualifications of Observer

Any intelligent individual can soon learn to make the observations and take the rough notes that are later used by the draftsman in constructing the process chart. It is natural, however, that the more experience the observer has the better and more quickly he can do the job. Familiarity with the processes under observation is usually a help although experience has shown that the alert mind of the trained process chart observer will often notice things that the mind familiar with the job will overlook as of no importance.

During the investigation which must be made as the notes are gathered questions will naturally be asked of superintendents, foremen and workmen and many valuable suggestions for shortening and improving existing methods are likely to be made by them. The observer should be sure to record all such suggestions for future reference and use when the work of reconstructing the plant methods is undertaken.

The completed process chart is handled in much the same way as were the stereoscopic photographs and slides described in a previous article. In fact, it is usual to show both charts and photographic reproductions of the various operations at the same time so that the process may be as clearly visualized as possible in order to bring out the most fertile suggestions. Here is another instance of the sound foundation of mutual interest and effort on which the Gilbreth methods are built. If the chart under discussion covers only a small department or part of a department the conference may include only the foremen and the men concerned, and perhaps the superintendent.

A more complicated chart covering the progress of a piece through several departments may require a foremen's meeting with the superintendent and planning department representatives. Still more elaborate ones may be put up to department heads or even to the board of directors if the change may mean a new policy. A group of such elaborate charts is shown in Fig. 4, where the strips have been hung on the wall so that they can be readily consulted.

A detailed description of their construction and of the use and construction of route models will appear in the next article.

Destructive Action of Doped Fuel

A recent Air Service Information Circular gives the results of tests to determine the effect of doped fuel on materials that might be employed in the various parts of the fuel system of an airplane. Four different fuels were used. The first was pure high-test gasoline; the second, 91 per cent high-test gasoline with 9 per cent antiknock; the third, 93 per cent high-test gasoline and 7 per cent monoethylaniline, and the fourth, 50 per cent high-test gasoline and 50 per cent benzol.

The first part of the test was conducted with the samples of the various materials cut into strips ½ in. wide and 4 in. long, so arranged that half of the strips were submerged in the liquid and the other half exposed to atmosphere saturated with the vapor of the fuel. No water was present. The first test showed that the following materials were very slightly, if at all, affected by doped fuel; Armco iron, duralumin, aluminum, zinc, tin and red fiber. The following materials were very badly affected by such fuel: lead-clad, copper, brass, cork, vellum and iron. The following materials were only partly affected: leather, textoil and Monel metal.

For the second part of the test, 25 c.c. of water were added to each fuel in order to simulate more closely actual conditions in an airplane fuel tank. As a result of the addition of water, it was found that only tin and red fibre remained in the very slightly affected class. Aluminum, duralumin, monel, textoil and leather were in the slightly affected class, while the other materials shifted over into the badly affected class.

It is interesting to note that Armco iron, which was badly affected in the presence of water, showed no signs of corrosion in the fuel alone or in the presence of water when amine dope was used.

The College Graduate on the Grill Again

BY ENTROPY

Thomas A. Edison says that college graduates do not want to get their hands dirty. A great many other persons have made the same observation but they have not been so well known or else they did not have such good press agents as Mr. Edison.

Are college graduates afraid of dirt, and if so are they right or wrong? Is there any good reason for anyone being afraid of dirt, or on the other hand, any reason why anyone should desire to get into it? The answer is, "It depends" not only on the graduate, but on the place where he is asked to get into the dirt, and by whom. Most college graduates have a normal amount of intelligence, otherwise they could not get through college. There may be exceptions among foot ball players and sons of professors, but these are few compared with the whole numbers, and it is possible that they do not exist outside of popular fiction. A person of normal intelligence bathes from time to time and otherwise endeavors to keep himself clean. As a matter of efficiency, getting dirty for the sake of showing off does not pay, nor does it appeal to most males after the age of fifteen. Getting dirty for a worthwhile purpose appeals to intelligent men. I have met very few, college graduates or otherwise, that hesitated about dirt if there was something beyond the dirt that showed a profit.

SKILLED MEN DO NOT LOVE DIRT

Shop men of the more skilled type hate to get into unnecessary dirt, but they always look on the green college man as a white collar man and consequently seldom stop to inquire whether he is or not, but on the other hand they do not inquire, when they see a new man in the shop, duffing into his work with a will, as to whether he is a college man or not. The college men are tipped off to keep pretty quiet about their diplomas and degrees when they enter a shop, and nothing short of a census will tell any shop manager how many college men he may have working for him.

Commencing work is a pretty serious thing for a graduate. Except for those who have worked in industry during their summer vacations it means a pretty cold bath taken very suddenly. It is surprising how many of them come through without making themselves objects of ridicule. The wiser ones work a large part of their vacations for the purpose, not only of earning money, but of getting used to shops so that they will not be so green when it is time to leave college to stay. Some colleges are arranging for their men to spend part of their time in actual industrial establishments before they are given their diplomas. There is a suspision that the reason is that such colleges are short of the funds to adequately equip a true shop, or else they have no one available that can run one, but whatever the reason there is no doubt that their graduates fit into shop jobs with less friction than those who have never seen the inside of a profitable shop before graduation.

Experience further shows that five years after graduation the college man finds himself giving orders to the non-college man, not in every individual instance but in the majority of cases. Records show that many college men go into jobs which do not require any dirty work, like sales, designing, etc. They make good without going through any more dirt than they met in college. If they make good, and they do, why criticise? No one can tell what was going on in Mr. Edison's mind when he made the statement attributed to him, but what many of us mean is that college graduates are putting a high valuation on their services and are expecting us to accept their training as somewhere near the value that the college from which they graduate has placed it. Consequently they are asking that they be allowed to enter industry somewhat above the level of a lumper, and sometimes above that of the skilled mechanic. The old idea that a man must enter industry by crawling in on his belly in abject submission to some foreman who rules by fear, and who delights in bullying them, is all gone. The firm will not stand for the financial loss incurred by letting a man capable of earning a living do work far beneath his ability, merely to allow a foreman to have the satisfaction of telling a saloonful of men how he made him taste the dirt. It simply is not being done any more, and not alone because the saloon is closed.

Next Phase of Automotive Engineering

BY HENRY FORD

In U. S. Air Service

The real champions of the people-at-large are our engineers and inventors. The inventor stands with the greatest benefactors of humanity. His work is permanent and the benefits thereof accrue till the end of time.

Centuries hence the times in which we live will be remembered as the period when automobiles began to contribute their economic service to mankind, and when men first began to fly.

Today the motor car is the greatest example of how an industry can influence the everyday life of millions. Automotive development has brought to a stage of reliability and economic performance the automobile, the motor-boat, and is now being used in the large ocean-going steamer.

In view, however, of the constant search for a means of annihilating time and space, the most serious attention and consideration are being given to aviation. Here is something new. We are standing on the threshold of a new phase of transportation. There is no doubt of the continued development in the navigation of the "air ocean," and such development will far surpass in rapid service any other means of transportation on land or water.

Aviation does not compete with surface methods of transportation. It is a supplementary agency. It is the conquest of the last element in the chain of man's control of natural forces. Henceforth, time, not distance, is the unit of commercial life.

The new art of flying brings new problems to automotive engineers and inventors. When airplanes reached the speed of approximately four miles a minute at Detroit recently, the layman could be excused for thinking that the ultimate had been reached, but there is still much room for improvement. About all that we have learned so far, is that we can fly; the rest is yet to be learned.

The inventor and engineer have the job of making the improvements which will guarantee economic performance, reliability, longevity, and safety in automotive equipment as applied to air navigation. And then the people of the country will have the job of adapting aircraft to the economic and commercial phases of our national life. Once given the safe and economical aërial vehicle, the public will find many uses for it.

Methods of Machine Tool Design

By A. L. DE LEEUW
Consulting Editor, *American Machinist*

Use of hydraulic and pneumatic devices in feed mechanisms — Friction drives of simple and complex design — The Sellers friction

IN THE DISCUSSION of feed screws, mention was made of the application of hydraulic feed, the main advantages of which are that it will produce an even and an unlimited amount of pressure. The uniformity of hydraulic feed is due to the fact that an accumulator can be used and the unlimited pressure is due to the fact that pressures up to 6,000 lb. per sq.in. are not at all uncommon. It was also mentioned that the chief difficulty of the application of hydraulic feed was in the regulation of the feed rate. A means for obtaining any desired feed rate was described. In that device the regulation was by mechanical means.

It is possible to get a fair amount of regulation by the use of a needle valve or choking bar. A needle valve is merely a device by which the opening of a pipe is reduced by the insertion of the conical point of a valve stem. The taper of such a stem may be made as long and as gentle as desired and, theoretically, it should be possible to obtain any amount of flow one may need for a given feed rate. As a matter of fact, however, it is extremely difficult to obtain such close regulation as one requires in machine tools by means of a needle valve unless the pressure per sq.in. is very small. Dirt or pieces of scale from the pipe may close up a large part of the small opening left in the pipe by the needle valve. Dirt also has an abrasive effect and, in the course of time, the opening of the valve for a given setting will be greater than it was originally.

Oil Better than Water

Where hydraulic feed is used with a needle valve for regulation, it is advisable to use oil instead of water. The reason is that water has a corroding effect on the parts of the hydraulic system which causes flakes of metal or oxides to be carried with the water. This is especially noticeable if the device has been standing idle for some time. Mineral oil has no such corroding effect on the parts of the system and, for that reason, is to be preferred.

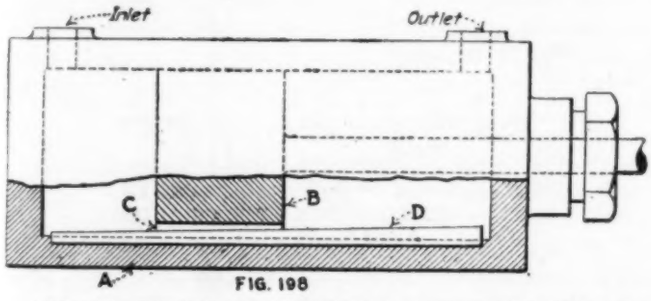


FIG. 198

FIG. 198—PISTON AND CYLINDER WITH CHOKING BAR

A choking bar is merely a taper bar which is laid inside a cylinder and passes through a slot of the piston. The amount of opening left between the choking bar and the slot depends on the relative location of piston and bar. Figure 198 shows such an arrangement in diagrammatic form. *A* is the cylinder, *B* is the piston in which a parallel slot *C* is cut. The bar *D* which has a very gentle taper is laid in the parallel slot in the cylinder. The oil must pass through the opening between this bar and the piston in order to come to the outlet. The piston is provided with means for moving it in an axial direction. A relatively large amount of movement of the piston is required for a small amount of reduction of the opening, so that this arrangement will give a much closer regulation of the oil flow than the needle valve. It is possible, however, to modify the construction of a needle valve by fitting a rod with gentle taper into a cylinder bored with the same taper as the rod.

The Variable Stroke Pump

Another device which has been used for variable speed drives but which might be used for the feed of certain classes of machines is the following: The oil is pumped by means of a piston pump with variable stroke and is delivered to a similar pump with fixed stroke. The rotation of a shaft drives the first pump and the reciprocating motion of the second pump is again delivered to a shaft. The speed of the first pump being constant will then give a variable speed to the second pump. Various means are used to change the stroke of the first pump.

As a matter of fact, this device when carried out in practice is much more complicated than it would seem from this description of the principle of its action. In reality there are two principal ways in which this construction is carried out. Instead of a first pump, there will be a number of them, all of them driven by an eccentric on the driving shaft. The pumps are located radially around the shaft, so that one after the other comes into action, thus producing a stream of oil with great regularity. Instead of mounting the eccentric directly on the shaft, it is mounted on a sleeve which, in itself, is an eccentric. Figure 199 illustrates the principle of this construction. *A* is the shaft. *B* is the eccentric sleeve, and *C* is the eccentric which drives the pumps.

As shown in this sketch the eccentricities of *B* and *C* are in the same direction, so that the total throw is the sum of the throws of *B* and *C*. If these eccentrics were placed as in Fig. 199-A, the eccentricity of the one would counteract that of the other and there would be no pumping action. The relative position of *B* and *C*

may be changed by various means. For instance, one might have a wormwheel on *B* and a worm on *C*, thus permitting *C* to be adjusted around *B*, and yet insuring that it will stay in place after it has been thus adjusted. The driven pumps, or motors, can transmit their motion to a shaft in various ways—by crank, or eccentric, or any of the ways in which gas engine cylinders are now used in airplane engines.

A Variation of the Pump Type Control

A method of employing this principle somewhat differently from the foregoing is the following. There are again a number of cylinders, this time located with their axes parallel with each other and also with the driving

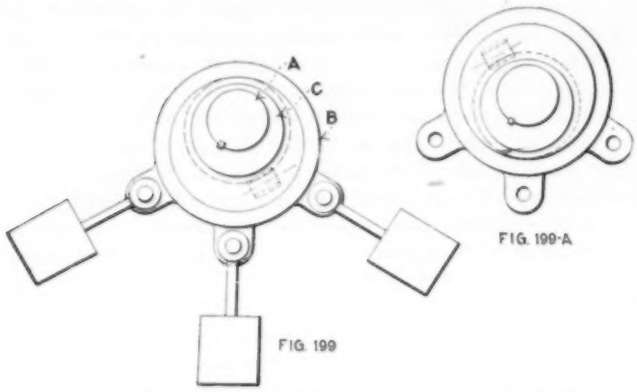


FIG. 199—DIAGRAM OF ECCENTRIC PUMP DRIVE

shaft. The piston rods bear against a plate which is set at an angle with the driving shaft, so that when this plate rotates with the driving shaft it moves the pistons in one after the other and forces the oil to a similar set of pistons, similarly arranged. The bevel plate on the driving side is adjustable as to the angle it makes with the driving shaft. When this plate is at right angles to the shaft it does not cause any motion of the pistons and when it is set to the maximum angle it causes the maximum amount of stroke.

The bevel plate on the motor side is not adjustable and is driven by the constant stroke of the various cylinders. This mechanism permits of speeds to the driven shaft from zero up to a maximum, this maximum being the same as the speed of the driving shaft. By the introduction of a valve plate which changes the port openings, it is even possible to reverse the direction of motion. No provision need be made for the return of the pistons from either side of this device because the return of the piston on the driven side causes the inlet on the driving side, while the forced inward movement of the piston on the driving side causes the oil to flow into the cylinders on the driven side.

Mechanisms of this kind have been used for the rotation of turrets on battleships and for other functions which require a large amount of power, a very gentle start, the possibility of quick rotation, and very gentle and slow termination of the movement. They have also been seriously considered for the drive as well as for the feed of certain kinds of machine tools. Their main disadvantage lies in the fact that they must be exceedingly well constructed in order to work at all and that this necessarily leads to high cost.

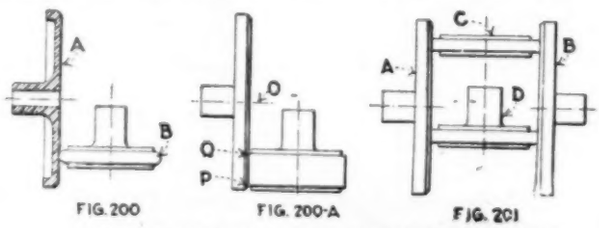
Pneumatic feeds are not to be recommended for most classes of machine tools. Though pneumatic devices are very useful for other purposes, they lack the uniformity of movement and the reliability which one expects in a feed mechanism. There is no possibility of making use of an accumulator to stabilize the pressure, and the medium employed is so elastic that the resulting movement is very apt to be highly irregular and jumpy. The fact that the air must generally be taken from the shop line, which is used for all kinds of other purposes, causes a great fluctuation in the pressure. It is not at all uncommon to see pressures fluctuating between 100 lb. and 40 lb. When using air for clutches, chucks or similar devices, no harm results from this extreme fluctuation because it is always possible to design the device to get the necessary driving power or clamping pressure with the minimum pressure one will ever meet. If air is used for a feed mechanism, however, such fluctuations are no longer permissible.

In certain cases the elastic action of the air is an advantage. If, for instance, parts must be polished or buffed it is well to feed the parts under the wheel somewhat slower when heavier resistance is met. A part might be located on a slide which is moved back and forth under a buffing wheel by a pneumatic cylinder. If the movement were perfectly uniform more metal would be taken off at the front and rear edge of the work than in the center, and the piece would appear to be rounded.

Though the actual variation from a perfectly straight surface would be very small indeed, this difference in height between edges and center would be especially apparent and would give the piece a rounded appearance. A pneumatic feed will overcome this to a great extent. As the edge of the work strikes the wheel the resistance is small and the movement rapid. When the center of the work is under the wheel, the resistance is great and the movement somewhat slower, which is as it should be. The result is that not so much is taken off the edge as would have been the case with a uniform motion.

Control of Feed Rate

Practically all devices used for changing speeds on a machine are also used for the control of the feed rate, the only exception, perhaps, being the use of two-speed countershafts. Sliding gears, back gears, cone and tumbler mechanisms, pull pin gears, and all other devices which we have discussed before, are used in some form or other in feed mechanisms. We have



FIGS. 200 AND 201—SIMPLE FRICTION DRIVE ARRANGEMENTS

seen, moreover, that cams are used and we will see now that there are still some other kinds of mechanisms which can be used to good advantage for feed, although they are not equally useful in driving mechanisms.

Drives by means of friction plates or cones are practically unknown in machine tool construction. We are not speaking here of the use of a friction clutch for the throwing in or cutting out of the drive but of devices which permit a change of speed. It is further true that such friction devices have been used and, to

a small extent, are still being used, for the drive of sensitive drills and a few other machines which require very little power. Where a considerable amount of power is required, however, friction drives are not applicable.

Two kinds of friction drives are in use for feeds. In the one type, shown in Fig. 200, a plate *A* bears up against a roller *B* and drives this roller at various speeds according to the distance from the center of the plate to the roller. The illustration shows the roller with a rounded portion where it bears up against the plate, thus making a line contact. In this form the device can transmit only a very limited amount of power. The moment we apply pressure to the plate, we will have a flat or cylindrical surface on the roller and, though this permits us to transmit more power, it also causes the chief difficulty one meets with this device.

A Diffculty with Friction Drives

Figure 200-A shows this condition of flattened roller in exaggerated manner. The speed which the point *P* has is that due to the corresponding point of the plate, in other words, proportional to the line *OP*. The speed at the point *Q* is proportional to the line *OQ*. As both points *P* and *Q* belong to the same cylindrical body, they cannot have different speeds and therefore there must be slippage. If, at any time, the load should be excessive, the plate will turn past the roller without taking it along and cause a flat spot to be formed. When once such a flat has started the application of more pressure to the plate will simply exaggerate the defect but will not help to turn the roller. It is essential, therefore, that this device should be so constructed that a very moderate pressure applied to the plate is sufficient to take the roller along and that at no time shall there be a tendency for the roller to stand still when the plate moves.

Another thing to keep in mind is to have the distance between *P* and *Q* as small as possible so as to reduce to a minimum the unavoidable slip which there must be between these two points. Still another point to be remembered is that it is not possible to bring the point *P* to the center of the plate. If this could be done, then we would have a speed variation by means of this device from zero up to the maximum. As soon as the roller approaches the center of the plate, however, the ratio between *QO* and *PO* becomes greater and with it the relative amount of slip. For this reason, it is customary to turn a recess in the plate at its central portion so as to make this part of the plate useless for speed adjustment.

Materials for Plate and Roller

Various combinations of materials have been tried out for plate and roller and it has been found that cast iron for the disk and leather for the roller give the best average results. One of the things to be borne in mind, when selecting materials, is that the roller shall not make a groove in the disk when it is kept in one position for a long time. This limits at once our choice.

Leather and cast iron have a high coefficient of friction, especially when the leather is used on edge. The way the roller is constructed may vary, but it has been found that, for relatively heavy work, three thicknesses of sole leather or harness leather clamped between cast iron plates gives the best results. The leather must be protected against grease, because oily leather is soft and will cause flat spots under the pressure of the disk. As it is not possible to guard entirely against oil on the leather, one should not use heavy pressures.

When it was found that the friction device, as described above, did not have the capacity required for very heavy machine tools, a modification, such as shown in principle in Fig. 201, was constructed for the feed mechanism of very heavy boring mills. In this construction there are two disks and two rollers, all contained in one common casing. The hub of disk *A* projected through the casing and was driven by a clutch on the driving shaft. This clutch had clearance in the teeth and did not bottom, so that a small amount of movement of the disk was permissible. Both disks were mounted in bearings constructed on the ball-and-socket principle, and the two were pressed against the rollers by one spring at the end of a rod going through the center of the disks. In order to permit the driven shaft to go through, this rod had an eye in the center through which the shaft could pass.

One roller *C* was hung in the casing free from the driven shaft and served as idler. The other roller *D* was movable on the shaft and keyed to it. A sleeve with rack teeth was hung from this roller and could be moved up and down by means of a pinion and hand wheel so as to furnish the necessary speed variation. By this construction most of the objectionable features of the friction drive were overcome. Though the roller may be round when new, it cannot be expected to stay round after it has been in use for some time. The pressure in the center of the disk does not permit the disk to follow all the irregularities of the roller with the result that, when it comes against a flat spot in the roller, it is very liable to aggravate this defect rather than to climb to the next high spot.

Adapted to Heaviest Mechanisms

With the construction of Fig. 201 the two disks are free to follow any irregularities there may be in the rollers. Besides, the driving disk *A*, in addition to driving disk *D* directly, drives also idler *C* and through it and disk *B* the roller *D*. Thus, even if all other conditions were the same, this device would transmit

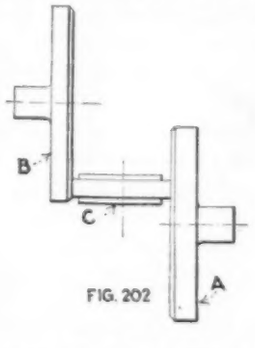


FIG. 202

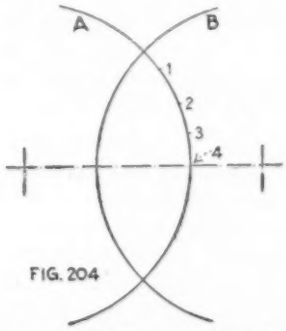


FIG. 204

FIG. 202—DISK ARRANGEMENT WHICH GIVES MAXIMUM VARIATION. FIG. 204—BEARING POINTS IN SELLERS FRICTION

double the power of the ordinary construction. As a matter of fact it was found that the capacity of this construction was many times that of the older construction, besides being adapted for the very heaviest kind of feed mechanisms.

A well-known adaptation of the friction disk may be found in the Cleveland automatic screw machine.

Figure 202 shows this application in principle; *A* is the driving disk, *B* is the driven disk, and *C* is the roller which transmits the motion from *A* to *B*. The two disks are set in such relation to each other that when *C* bears against the largest diameter of *A* it bears against the smallest diameter of *B*, and vice versa. In this manner, a much greater variation in speed is possible than with the single disk and roller. If, with this latter construction, the largest diameter against which the roller can bear is *D*, and the smallest diameter is *d*, then the ratio in feeds obtainable is $\frac{D}{d}$. With the construction as used by the Cleveland Automatic Machine Company this ratio is $\frac{D^2}{d^2}$.

Effect of Slippage

Though simple in construction and useful in many cases, it should be remembered that the friction disk and roller do not give a reliable feed so far as the actual amount goes. There are two items which make this amount uncertain. The first is slippage due to the fact that there may be flat spots, or that the pressure against the plate may not be sufficient to drive the roller at some moment. The second item is the fact that the roller has thickness where it bears against the plate and that we are never certain whether the plate drives the roller at the top of the leather disk, at the bottom, or somewhere between.

If, for example, the size of the plate were 12 in., the size of the roller 6 in., and the thickness of the leather ¾ in., we would have a ratio of 12 to 6 if the roller were as far out as possible and if we assumed that the disk bore against the lower edge of the leather.

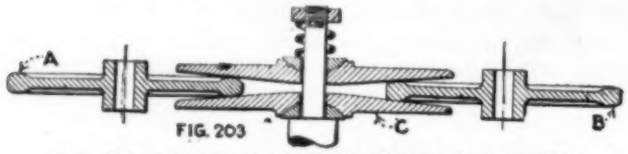


FIG. 203—DIAGRAM OF THE SELLERS FRICTION

If, on the other hand, we assume that the bearing is against the upper edge, then the ratio will be 10½ to 6, which at once gives a difference of 12½ per cent in the speed of the driven member. This condition becomes even worse when the roller is near the center of the disk. If we suppose that the recess in the center is 3 in. in diameter and the roller is as near the center as it can be brought, we have either a ratio of 3 to 6 or 4½ to 6, a difference of 33⅓ per cent.

Uncertainty of Friction Feeds

When designing such a friction device we would naturally assume that the bearing was in the center of the thickness of the leather roller which would give for the largest working diameter of the disk 11¼, and for the smallest 3¾. This would give a feed range of 11¼ to 3¾, or 3 to 1. According to circumstances, however, the largest diameter of the disk may be either 12 in. or 10½ in. and the smallest diameter either 4½ or 3. Sometimes, therefore, we may have a feed range of 12 to 3, or 4; and at other times only 10½ to 4½, or 2½. As a consequence, the operator of the machine is never certain as to what feed he is using and must rely entirely on his judgment. This defect is exaggerated in the case of the automatic screw machine mentioned above. If rollers and disks of this size (12 in. and 6 in.) were used, the feed range might sometimes be $4^2 = 16$, and at other times $2\frac{1}{2}^2 = 5\frac{1}{4}$. The construction shown in Fig. 201 minimizes all of these shortcomings, but is not entierely free from them. Notwithstanding all the bad features enumerated here, there is a place for the friction feed in machine tool construction.

The Sellers Friction

Another well-known friction feed is the so-called Sellers Friction, which is shown in diagrammatic form, Fig. 203; *A* is the driving disk and *B* the driven, while the intermediary disks *C* are mounted on a swinging arm and can be brought either to the right or the left. These disks are all made of metal. As a rule the stationary disks are made of cast iron and the swinging disks of bronze. These swinging disks pinch the stationary disks by the action of a heavy spring, mounted on the stud, on which these swinging disks are located. Cupped hubs and spherical washers permit the disks to assume whatever position is necessary when they are swung from right to left, or vice versa.

It will be noticed that these swinging disks are made in the form of flat cones. If this were not so, the manner in which they would bear against the stationary disks would be as shown in Fig. 204, in which *A* is the swinging disk and *B* the stationary one. It will be seen that the points 1, 2, 3, 4, etc., of the swinging disk all bear on different diameters of the stationary one, so that there will be a large amount of slippage. In fact, it seems very doubtful if such disks will do any driving at all.

By making the swinging disks of conical shape, the point 4 will be the only bearing point. On the other hand, this also causes the disks to swing around when they are moved from one point of contact to another and this is taken care of by the spherical washers. It also causes the disks to be further apart or closer together according to the position they occupy. In the central position, where they work with equal radii on the two stationary disks, we find the minimum distance between the two swinging disks. Their distance increases when we move them to either side of the center. This increase of distance causes an increase of the pressure exerted by the spring. While this is not altogether desirable, it does not cause any serious difficulty.

Etching Reagents for Alloy Steels

Considerable attention was paid during the past month by the Bureau of Standards to the problem of finding an etching reagent by which chromium carbide could be distinguished from vanadium carbide in a positive and satisfactory manner. Only one out of about 20 of the reagents tried seemed likely to be of much use in this connection. This is a hot solution of potassium permanganate and sodium hydroxide, etching in which for one minute darkens chromium carbide to a strong brown-red or brown color, or rather, the carbon is eaten out giving the walls of the cavity thus formed a dark brown-red color, while vanadium carbide remains uncolored and apparently unattacked.

Another but less positive means of distinction is that obtained by electrolytic etching with a weak current in a dilute aqueous solution of ammonia or sodium hydroxide. The chromium carbide is eaten out leaving a dark brown-red or brown cavity, while the vanadium carbide is eaten out apparently at a slower rate leaving cavities which appear light and not at all darkened.

A Merit System for Establishing Wage Rates

By K. H. Crumrine

OF THE many plans for establishing wage rates in the average machine shop none is perhaps more common than that of hiring a man for as little as he will work, advancing his wages only when necessary, and letting him go when he is no longer willing to work for what has been arbitrarily determined as a maximum wage. In shops where this method is in vogue more effort is often expended in finding a workman's faults and weaknesses to hold against him when he applies for a higher rating, than is exerted to determine his good qualities. It has long been the opinion of the writer, however, that a good quality discovered, profited by and rewarded is of much more value to an employer than a fault punished, with its attendant discomfiture to the employee, not to mention the chances that occur of losing the services of a man on whom time and money has been spent in training.

In ordinary times and under ordinary conditions the average shop grants wage increases to a certain average percentage of its employees each month. While in many cases such wage increases are conceded for fair and legitimate reasons, it is no doubt true that many increases are allowed for reasons which could not be made applicable, in general, to the other employees of the factory. Many men are given increases of pay because their employer feels that they are worth more and does not wait for them to ask for it. On the other hand, how often have we seen the man who had the nerve to ask receive an increase in his pay while his equally good neighbor, hesitating to make his feelings known, plods along at the same rate month after month and year after year?

Production Depends Upon Incentive Applied

Some men are advanced because they are loyal, or their employers like them, some for length of service, and some because they seem to need the money. In fact there are many reasons why wage increases are granted in the average shop. Ordinarily, there seems to be no definitely established standard which an employee must meet to merit an increase in his earnings, or any assurance that he will receive the increase if he should comply with such a standard. This lack of a uniform standard tends to cause dissatisfaction and jealousy and lowers the spirit of co-operation throughout the plant. A certain acknowledged standard, however, applicable to all, and incorporated in a system of team play (because a man who is interested as in a game can perform a vast amount of work) would increase production and foster loyalty.

In some of the larger city stores, goods which are not sold within a certain length of time are placed in an automatic bargain department, where their prices are lowered a certain amount each day until they are disposed of. It is absolutely certain that they will be sold when their price arrives at a certain level, and also just as sure that their price will progress toward that level until they are sold. This illustration is intended to bring out the idea that as the sale of the goods depends largely on a price properly regulated, so also production depends largely on a proper amount of incentive properly applied.

The sale of the goods is what the store wants and gets. Good pay is what the workman wants but in many cases does not get, because he does not give his employer that most desirable and important consideration, good production. These last two desires are most creditable, however, and may be as easily realized as the first, provided that proper standards are arranged.

A Universal Plan Based Only on Merit

The following is an outline of a plan based entirely on merit, whose one standard is efficiency, by which is meant doing in the best and fastest way whatever a man may be hired and paid to do, or an improvement on his method of accomplishment, regardless of what it is. The principle of the plan is universal, and is as applicable to the poorest sweeper as to the workman of the greatest skill.

In introducing the plant, the employer announces that on a specified day of each month a certain percentage of the workmen in each department (perhaps 20 per cent) will receive a reward for having been selected as those who have, during the previous month, most nearly fulfilled the object for which they were employed. This reward may be an amount of money equal to one day's pay, or to some other specified amount.

The employer also announces that the ones to receive this reward shall be selected from the entire department by a committee consisting of the department foreman, his assistant, and the general shop foreman, superintendent, or employment manager. Their opinion is to be based on each man's skill, speed, accuracy, prompt attendance, suggestions for improvement, care, deportment, loyalty, and all other qualifications which tend to make an employee worth hiring and keeping on the payroll.

The vital feature of the plan is that if an employee has been selected to receive this reward for a specified number of consecutive months (say three), or for a greater number of months not consecutive, he shall automatically be entitled to a specified increase in his daily earnings. Also this standard shall ordinarily be the only one which shall entitle him to such an advance. This procedure may be repeated continuously until an employee receives a rate of pay which the employer has announced shall be the highest for his class of work. Such a rate must, of course, be high enough to be attractive or no one would put forth the necessary effort to attain it. After the employee has reached the highest rate for a given class of work, he is still entitled to receive the monthly award if selected by the committee.

To sustain interest in the plan, the names of all selected to receive awards and all who earn increases of pay shall be announced by bulletin in each department immediately upon their selection. The amount of the award or increase need not, of course, be given, although the principle underlying the plan would in no way forbid such a method if it seemed desirable.

Do Economic Conditions Affect Plan?

Perhaps the first question which will occur to the reader is, "What occurs in slack times, extreme depression, or on the other hand, in times when the working of the plan would be too slow to keep employees content in the face of higher offerings by other shops?"

Under such conditions this plan presents difficulties no greater than those met with in any other plan. The plan is not intended as a cure-all, but is offered as a systematic substitute for the haphazard methods often used. In times of depression if a general reduc-

tion seems necesary it can be made and this system, as well as any other temporarily suspended, the ratings to be restored when conditions warrant. In good times, surely, there could be no objection to a general increase, entirely independent of this plan, should it seem desirable. Employees in general are not slow to realize when conditions are good or bad; but if they should be, the fair-dealing employer would not find it difficult to show the actual conditions.

The plan may be started at any time using the present ratings. New men are hired in the usual way, at rates which are satisfactory to their employer and themselves. But these rates must be, to a reasonable extent, in accordance with the plan just described. After starting work, each man's status depends entirely on his desire and efforts to give satisfaction.

There can be no good reason why anyone should wish to prevent an employee from getting an award because a certain definite number must be made each month. Neither can the personal feelings or friendships of any member of the committee have any bearing on a case because he is checked by the other members of the committee.

Perhaps awards to 20 per cent a month may be too few to make, or it may be too many. This would mean a possible maximum of 6⅔ per cent of wage increases per month, but this would never be attained as it is scarcely possible that the list of honor men would be the same each time. There might be granted a percentage of awards which would permit a possible maximum number of wage increases about the same as the usual average. It could also guarantee that the percentage would not be lowered, except in case of temporary suspension of the system due to business depression, but possibly the rate might be increased if the working out of the plan should seem to warrant it. Too high a percentage of awards, of course, would not be practical as there would be too little incentive to really earn them and the expense of paying them would, therefore, be out of proportion to their benefit.

Plan Just to All Employees

The workman cannot object to this plan because by so doing he informs his employer that he is not the type of man wanted. The employment manager should be happier in seeking qualities to reward than for those to penalize. The men should be pleased to know that their efforts are to be noticed and appreciated. They must be noticed; otherwise the employment man would have comparatively little to do.

With a plan of this type all piece and premium work would be done away with. It is admitted that rates for that type of work cannot be fairly adjusted in the average shop. It is well known that it is possible for one man with very little effort to make a high premium while another, no matter how hard he tries, cannot make as much, owing to the nature of his job or equipment. It is impossible, or at least impractical, to set premium or piece rates on all jobs. We find two men, therefore, working in close proximity, one doing a day's work and receiving a day's pay, while the other earns a good premium although he has possibly less ability than the other and probably works no harder. The inexperienced man with little training, but doing repetition work may earn more than the skilled toolmaker of long experience.

Under the plan being described a man would not try to produce as large a number of barely passable pieces as he could. Rather, he would try to make as many good pieces as possible, because quality would have as much effect on selection for the awards as quantity. The only requirement is that a man must make every effort to work for the best interest of his employer. Whether this might mean fast work, close work, neat finish, promptness, honesty, attention to detail, makes absolutely no difference whatever so long as it is what his employer has hired him to accomplish.

The question will doubtless be raised as to whether it is possible to make such awards in true fairness and without causing dissatisfaction. Any foreman who is intelligent enough to be a foreman, and who is constantly among his men, knows perfectly which of them are working for their employer's interest and which are not. There is no one whom the right kind of man would rather have pass on his standing than his foreman or assistant foreman, for they know his true worth and value. There will be dissatisfaction, undoubtedly, amongst those who do not receive the awards, but the obvious remedy is for them to put forth sufficient effort to earn one another time.

The main point then upon which the plan depends is that the employer, represented by his employment manager, must search for good qualities instead of poor ones, strong points instead of weak ones, and those which he can reward and profit by instead of those which he must punish.

Carbon Formation in Engine Cylinders

"Freedom from carbon" has become the war cry not only of the lubricating oil salesman, but of the vender of pistons and piston rings as well. Its appeal lies in the fact that "removing carbon" appears rather frequently in the expense account of the average motorist, and that the need for carbon removal is usually made manifest by a period of extremely poor engine performance. The past few years have witnessed considerable progress in preventing excessive quantities of oil from entering the combustion chamber and the formation of large amounts of carbon from this source is somewhat less common than it was. However, there still appear to be differences in the rate at which carbon accumulates in engines, which cannot be satisfactorily explained through variations in the amount of oil entering the combustion chambers. A possible explanation of some of these differences is furnished by some recent tests made at the Bureau of Standards.

These tests included runs of several hours' duration at full load and at about one-third load. Carbon deposit on the spark plugs was very bad at the low load and negligible at full load. The deposit on the piston head, however, was decidedly worse at full load than at part load. The conclusion, which has been verified in other ways, is that at full load the temperature of the piston is favorable for the formation of carbon while the temperature of the spark plug is too high for such formation. On the other hand, at part load the temperature of the spark plug is favorable for carbon formation and the temperature of the piston head is too low.

If, in the course of normal engine operation, there are times when portions of the combustion chamber are too hot for carbon to form and other times when they are too cool, it seems reasonable to assume that the rate of carbon formation depends upon the conditions under which the engine is operating, and that there is a certain load at which carbon formation will be a maximum.

Why Too Many Firms Fail

By John R. Godfrey

MY OLD FRIEND Johnson called up the other evening and asked me to come down to his house. His oldest boy Tom is just through college and he wanted me to help him give the boy some good advice. Now I knew perfectly well Johnson didn't need any help and that I probably wouldn't get a chance to say anything anyhow. But I was rather glad of a chance to hear Johnson hold forth, so I was on hand at the appointed hour, and Johnson didn't waste any time getting over the preliminaries.

"Godfrey, old man," he started out. But somehow that adjective "old" doesn't seem half as chummy as it did ten years ago. "Tom has been spending four years loading up with a lot of things you and I never got a peek at, things we ought to know but don't. But I'm trying to tell him that there are some of the things we've learned that all the colleges in the world can't teach him. We learned how to work with our hands and how to do things that don't grow in text books; things that are at the bottom of every successful business.

"Now, I don't mean that Tom is lazy. He can play tennis by the hour and dance 'til sun up. Likewise, he can chase the festive lawn-mower and do a few dirty but useful jobs in the shop. But he doesn't quite see why he should spend three or four years in the shop at the lathe and the bench, before he begins to take over some or all of my burdens. It isn't easy to tell him why so I asked you down to help me hold a post-mortem on some of the big businesses in this town and see if we can't show him that they are suffering from fatty degeneration of the pocketbook and what caused it.

What Happened to Excelsior

"Take the Excelsior Box Company that old man Starr started over forty years ago. Joe Starr knew boxes better than he knew his wife's relations. He'd made 'em with his own hands, he knew every twist and turn for getting boxes out at low cost and for selling them too. More than all that he knew men, and especially his own men. He worked long hours with his men in the old days. And he never got beyond being called Joe by his own cronies or of knowing as many of his men as possible by their first names. Knew their families and was generally interested in the sons and daughters and their new babies.

"Now Joe Starr never had an education, but he gave his son Percy the best that money could buy. Wanted him to learn the technical side of manufacturing that he had never fully understood, so he could turn the works over to Percy and take it easy in his old age. Percy was a good sort of a chap in spite of his name, which wasn't of his own choosing. He meant to do the right thing but he didn't know how. His dad didn't realize that knowing how to work is even more important than a college education. And Joe sort of coddled Percy after his mother died, not knowing he was doing the worst thing possible for the boy and the business he was to take over.

"When Percy came home from college he had an education with all the trimmings. There wasn't a better dancer for miles and he was some popular with the girls and the boys too—of the dancing set. But when it came to going into the shop for three years and learning the business from the ground up, Percy couldn't see it. It didn't fit in with all night dances to be on the job when the whistle blew the next morning. And what was a college education good for if you had to go into the shop and learn it all over again.

"Joe Starr compromised by letting Percy hit the high spots in the factory for three or four months. But he never really learned how to work or what work meant. He didn't get to know the men in the shop. Not because he intended to be uppish, but they didn't travel in his social set and he hadn't any real interest in them. He couldn't see any connection between knowing the plant and its men and getting economical production.

"Old Joe was pretty tired by the time Percy had graduated from his four months' bluff at working in the shop and it wasn't long before he went up into the woods on a long fishing trip. Lord knows he had earned a rest and no one blamed him for taking it, but everyone was dubious at seeing Percy at the helm. He was a likeable chap, plenty of poise and dignity but an utter lack of real knowledge about the business. The men didn't know him any better than he knew them—and they hadn't any confidence in him. And when men lose confidence in the boss, there's trouble in the air.

Knowing When to Bust the Rules

"One of the great troubles with college men is that they get the idea that business management is learning a set of rules and following them. That was what ailed Percy. He'd studied management, scientific and otherwise, and he thought that all you had to do was to sit in the office and get reports from department heads. He didn't know that reports never tell the whole story and that it takes personal contact with the shop, or as much of it as possible to know what is really going on.

"He was one of those birds—and there are a lot of them—who think that rules mean management. You have to have rules, of course, but Godfrey and I know that *real management means knowing when to bust the rules.* And you can't know that unless you know the game from start to finish. You've got to know the shop so well you can sense it whenever something is going wrong, as it does at times, even in the best regulated families.

"Percy didn't know when to bust the rules and the wouldn't let anyone else tell him. The men in the shop no longer had anyone to be loyal to and you can't expect loyalty without giving something in return. His best men drifted away, production dropped, overhead went up and profits disappeared. Then he got a large loan from the bank and the bank put in a man to run the plant. There may be cases, Tom, where a bank picks the right men to run a plant, but I've never seen one. Frank Vanderlip wrote a nice article a few years ago on how he picked his $25,000 men—but did anyone notice any brilliant managers picked by the bankers to run the munition plants during the war? If I hadn't picked better managers for foremen than they did to handle big plants, there wouldn't be any business for you to manage some of these days, Tom. If you ever get to the point of getting the bankers in this concern you better go out and dig up a job somewhere else. There won't be enough remains to hold a decent funeral over.

"Then there was the Acme Gas Engine Company, almost the same story. Used to work there myself and knew old man Jones when he was running the place right. We'd all work our fool heads off for Jones any day. But when he turned the plant over to his son-in-law who had been head soda water jerker in a high toned drug store, the end wasn't long in coming. The

boy tried to learn gas engine building from a desk in the office and got so he could tell a spark plug from the exhaust manifold, but he didn't know the game and the same thing happened there. That's really what made the chance for me to go into the gas engine game. And I want you to really know the business so you can *stay* in it. These are only two cases but they ought to satisfy anyone who doubts the necessity of getting a real inside knowledge of the business.

New Management Problem Now

"Tom, my boy, you're going to have a harder job than I did, in some ways. I worked ten to fifteen hours a day building this business up. My men worked with me, largely because I worked myself and they knew I could do any job in the shop. Those days have gone. Eight hours is the rule now and I'm glad of it. It's enough with the lack of variety that comes from so much automatic machinery. But it brings new problems that you've got to face—and master—or the Johnson Motor Works will go like the Excelsior Box Company.

"You can't know the family history of every man as I did, but you've got to come as near to it as you can. First, by learning the motor business from the bottom up, and next, by learning to know the men. You've got to learn their way of thinking, how things appear to them—psychology you college chaps call it. You'll find they're apt to be suspicious until you show 'em you're playing the game squarely. You can't blame 'em either, for they've had a lot of jokers put over on them under various guises and by various names. But they'll play fair if you do. After you've lived with them a while you'll find out that they are real men, with real ideas and ambitions, even if they don't go in your social set. And don't forget this, son, whether you like them or not you can't run this business, or any other, without them.

"In the days when Godfrey and I were in the shop, there were but a small number of men and the boss knew every man and all about him. Every man knew about the boss too. Knew he was working hard to build a business and so worked with him. He knew where every machine was going and was almost as much interested in the work as the boss himself. The big shop with its departments, has changed this. We let a lot of the interest drift out of the big shop and its up to the new managers to bring it back and then keep it as they would any valuable asset.

Putting Human Interest Back in the Shop

"Shop committees, work councils and other things are attempted, to put back the human interest that the personality of the old boss put in the business. But in too many cases these things are introduced without knowing or caring what the real object is. It's like Percy Starr and his rules of management. Unless you know the men, know the kind of human interest and encouragement they want and need, and are honest yourself, no plan will work out for long. Too many plans of "industrial democracy" have been installed as a sop to men who were dissatisfied with the shop because of its lack of human interest. If the management and men know and trust each other—any old plan will work. If they don't the best plan will fail to bring the desired results.

"Money isn't everything son, either to the man in the shop or to the boss. But don't think that calling a man Bill and asking after the kids takes the place of a fair wage in the pay envelope. They belong together and if your men are with you, you can well afford to pay even more than the market rate, for you'll get production that will surprise anyone who doesn't know what real co-operation will do.

"Tom, my boy, I'm depending on you to carry-on when I'm out of the running or tucked away in an urn. And it isn't just because I worked twelve hours a day that I want you to go into the shop for a few years. It's because I want you to be able to run it better than I have. Your education, plus actual experience with motors and men, will help you build this into a bigger and better plant than I ever could.

Learn Men and of Men

"Go into the shop and learn men. Show 'em you are as fair and honest as they are. Help them whenever you can, and let them help you. For even if they wouldn't know an algebra sign from a laundry ticket, they know a lot which you've got to learn. Be one of them—not like a chap condescending to do time with 'em because your dad wants you to. Learn to know them and their aims and ambitions and you'll understand and sympathise with them in many things. Play fair with them and you'll have the Johnson Motor Works a model for good-fellowship and production, for they go hand in hand with the right management.

"Guess I've talked an ear off both of you. But it's a subject that's very near to my heart Tom, and I know you'll come through O.K. Remember that no business can be run on rules alone, it needs real men who know the game. And if Godfrey here happens to be around when I'm not, he'll help steer you right if you need it."

As I expected, Johnson did all the talking. But if Tom follows his dad's lead, he wont come to the cropper that Percy Starr did. Nor will the Johnson Motor Co. go on the wrong side of the ledger.

To "Potter" or to "Scog"

By D. G. Meikle

On page 117, Vol. 58, of the *American Machinist*, one of your contributors gives a very interesting explanation of the origin of the expression "to potter."

Looking at the modern steam engine, it does not seem possible that the first engines were left, so far as timing devices for valve opening and closing were concerned, to the mercy of boys, who, like the present generation of boys, had the idea that all work and no play was a poor kind of existence.

Now the fact that Potter had this idea in mind when he invented his rigging, is known by the fact that he himself named the contraption, and the name he gave it showed what induced him to think it up. If the old Scotch engineer who told the yarn is correct, and it seems borne out by facts, the boy called the mechanism a "scoggin catch," which he coined from an old Scotch verb "to scog," meaning "to loaf" or "to skylark," or in fact to do anything that had no useful purpose.

Now this is slightly different from to potter because most people have the idea that pottering means mostly doing some kind of work, but without haste or without any defined plans in mind, rather in the nature of amusing themselves by working for pleasure, instead of from necessity. However we get back to the fact that if to potter is to invent something useful and not to loaf, then Potter pottered only so that he would have the time to loaf, or as he put it "to scog."

Ideas from Practical Men

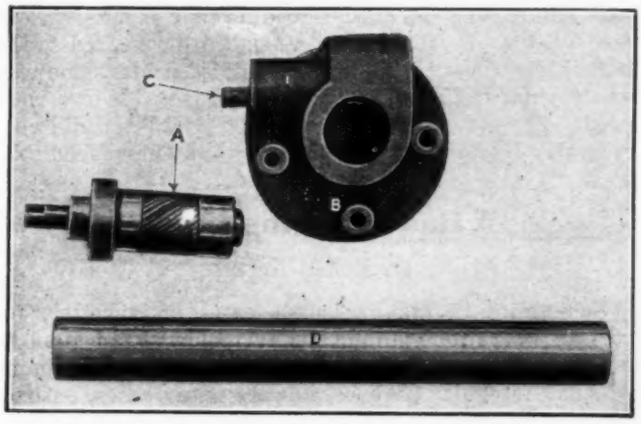
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Device for Milling Seats on Locking Bolts

By George Edgar

Herewith is shown a handy milling tool for cutting the "flat" on a clamping bolt used to lock a sliding bar in place. As only a few clamping bolts are used, it doesn't pay to set up a milling machine for the work, and yet filing doesn't produce accurate enough results.

The helical cutter *A* is held on a spindle running in two bearing bushings. The tool is inserted in the large hole in the casting *B* after the shouldered clamping *C* bolt is in place and the nut put on. Then, as the milling cutter is turned with a wrench, the nut on the clamping bolt is gradually tightened until the



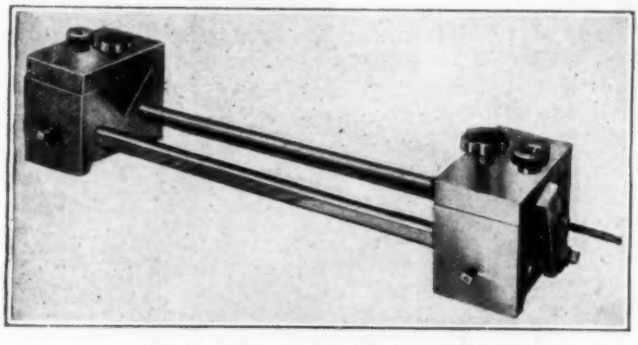
DEVICE FOR MILLING SEATS ON LOCKING BOLTS

proper seat is obtained. With a seat as accurately cut as can be done with this device, it is easy to securely lock the sliding bar wherever wanted with a very slight turn of the nut on the clamping bolt. The bar to be clamped is shown at *D*.

A Drilling Jig for Round Stock

By Everret Shawn

Several writers have recently described jigs for holding round stock for drilling. The jig shown has been



A DRILLING JIG FOR ROUND STOCK

used in our shop for several years. The stock is slipped through the Vs and butted against a stop. Thumbscrews are used to clamp the stock while drilling. Two holes may be drilled with this jig at one setting and it is so made that the distance between the holes can be varied considerably. Slip bushings are used to allow for different sized drills. This jig is easily made and can be arranged to suit a large variety of work.

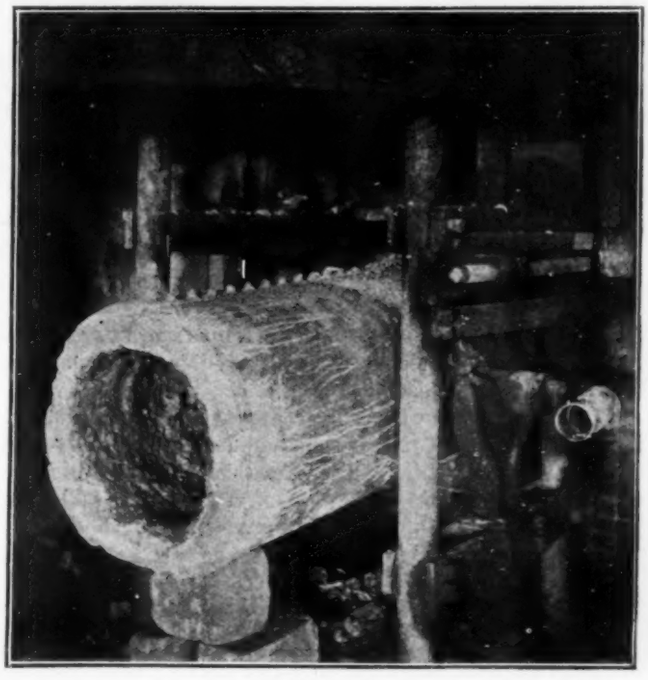
A Tilting Cupola

By Sandy Copeland

The cupola shown herewith is so small in diameter as to make the relining of it a difficult task and so the lower section is hung on trunnions in order that it may be lowered to the position shown in the photograph.

The stack, in which is the charging door, is permanently supported by the framework. The lower end of the stack is bell-mouthed so that when the cupola is raised to a vertical position it is not necessary to make a joint between it and the stack.

The cupola is fitted with the usual drop-bottom to get rid of the remains of the charge after the run is



A TILTING CUPOLA

completed. The blast is delivered to the tuyeres through one of the hollow trunnions.

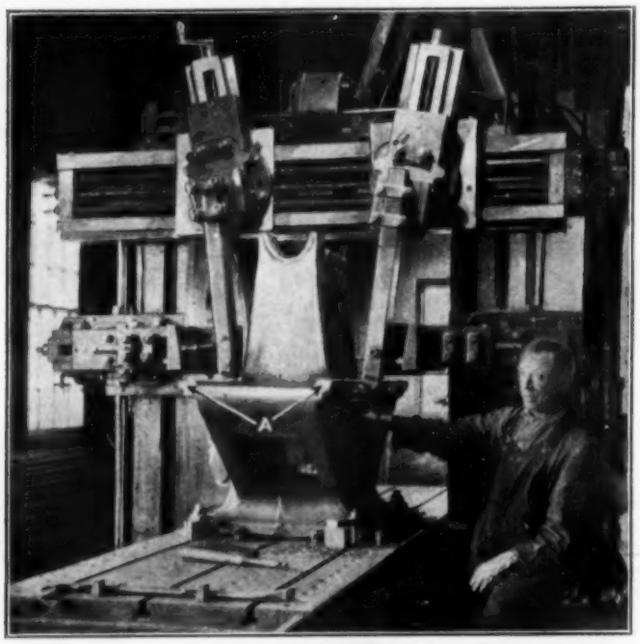
The section here shown is perhaps 4 ft. deep by about 16 in. in diameter and though the relining is not exactly child's play it is much easier of accomplishment than would be the job of relining a vertical cupola of such small diameter.

Long-Distance Planing

By Henry M. Clary

The frame, or bed casting, used in one of the latest products of the Badger Tool Co., Beloit, Wis., has an angle on the finished surface on each side of the casting, as indicated at *A* in the illustration. As the central portion of the casting rises a couple of feet above the surfaces mentioned, when the cross-rail is high enough so that the casting can pass under it, it is so high that ordinary tools can not reach the work.

The foreman had two bars of 2½-in. square steel cut to length and made into toolholders as shown in the photograph. A square hole was made through the lower end of each bar for the toolbit, and just above it a hole was drilled and tapped for a ¾-in. bolt. Then two angle plates were made, the inner surface on one side of each being finished to the angle required on the casting, and these plates were attached to the side heads as shown.



LONG-DISTANCE PLANING

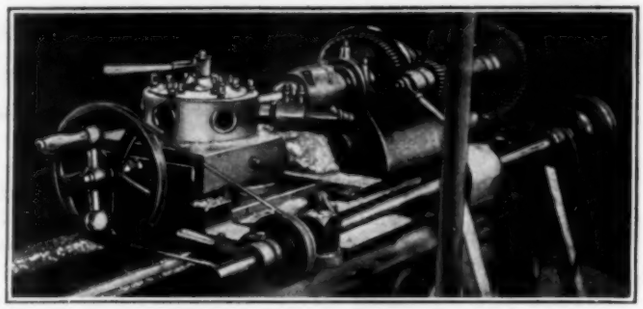
Special bolts with large heads were made to fit the ¾-in. holes and the toolholders were clamped in the toolblocks on the cross-rail heads.

The heads of the bolts bear against the tapered surfaces of the angle plates so as to keep the toolholders from springing, while at the same time maintaining the correct angle.

Power Feed for an Old Lathe

By George Allen

The article by William Clancy on page 1008, Vol. 57 of the *American Machinist* about putting power feed on an old lathe reminded me of one we put on an old fashioned turret lathe a few years ago. As shown in the accompanying illustration, the old turret lathe referred to originally had only hand cross and longitudinal feeds which were operated in each case by a large ball crank. We had a large number of bushings to bore out and decided to arrange the old machine so it would automatically feed in the boring tool. This we did by putting a shaft at the back of the machine with a



POWER FEED FOR AN OLD LATHE

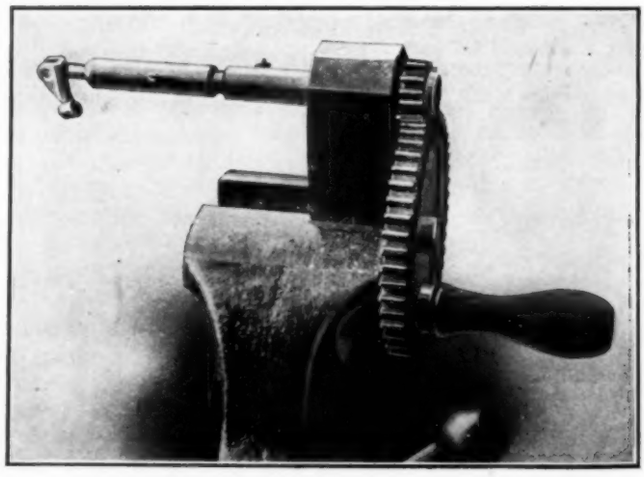
grooved pulley on it as can be seen in the illustration.

A large grooved pulley was also put on the longitudinal feed screw of the turret and a round belt used to connect this pulley with the one on the back shaft. Tight and loose pulleys were fitted to the head end of the back shaft and a rod rigged up from the front so as to shift the drive belt onto the loose pulley at the end of the cut. An emergency clutch was also rigged up so that the turret feed could easily be thrown out by means of a lever shown near the end of the back shaft. The reverse feed was obtained by means of a cross belt running on a pulley next to the one on the back shaft that gave the feeding movements. Both feed belts were driven from a small drum geared to the lathe spindle and the belts were shifted in the same way as those of a planer except that two loose pulleys were used. The arrangement worked very well and did considerably better work than with only the hand feed.

A Hand Tapping Device

By Edgar Allen

Sometimes in making small parts it is better, for certain operations, to do the work by hand than to attempt it on any of the regular machines. The tapping of small irregular parts is, in very many cases, entirely hand work which is necessarily slow. To speed up work on jobs of this kind, we made the device shown in the illustration. The construction is so plainly shown as to need no explanation, since one of the tapped pieces may be seen hanging on the end of the tap at the extreme left. A girl can tap small brass parts about as fast as she can pick them up. The number and variety of pieces that can be tapped with this device in a day is astonishing.

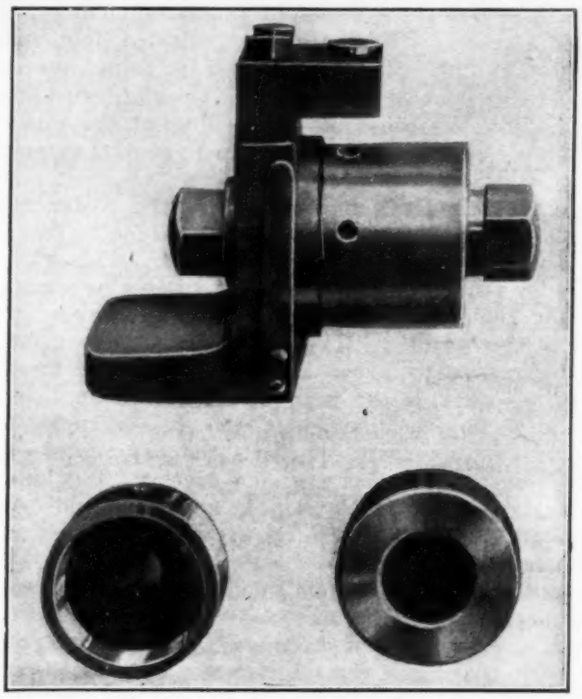


A HAND TAPPING DEVICE

Jig for Drilling Spanner Holes in Gland Nuts

By Frank Avey

The jig shown herewith is a simple little indexing device for drilling the spanner holes in brass gland nuts. Two of the gland nuts are shown in the foreground and one in the jig. The nut to be drilled is slipped over a



JIG FOR DRILLING SPANNER HOLES IN GLAND NUTS

rotating holder and against a shoulder in which are cut notches corresponding to the holes to be drilled in the nut. A spring latch screwed to the side of the base casting acts as a spacing and locking device. The jig is attached to the drilling machine table and the spindle stop set so that the drill will go just deep enough for the spanner pin and not entirely through the shell of the gland nut. Any boy can operate the jig and get good results after it is properly set.

Reducing the Diameter of a Hole by Heat

By F. M. A'Hearn

A good illustration of the possibilities of making a hole smaller in diameter by heating the surrounding metal, presented itself to one of our workmen the other day without previous arrangement or intent when he tried to shrink a piston on a rod.

The job was shrinking an ordinary locomotive piston of the assembled type on the rod. The hole was chamfered at one end and the rod shouldered far enough back to allow it to project for about $\frac{3}{8}$ in., so that the extra length could be riveted over into the chamfer and assist the shrink to hold the piston on the rod. It was customary to reduce the diameter of the rod for a distance of $\frac{1}{2}$ in. from the end by the amount of the shrink allowance for the purpose of facilitating the entering of the rod in the heated piston when making the shrink.

The machine work was finished in the usual manner and the reduced end of the rod set into the hole in which way it was sent to the blacksmith shop for shrinking.

The blacksmith who did the heating had had little experience with work of this kind as was evidenced by the fact that he built up a ring of wet coke around his fire, placed the piston over it and filled the hole with coke so that the fire would draw up through it as if it were a chimney.

When the blacksmith had brought the work to what he thought was a proper heat he called in the machinist to witness the shrink, but, much to the astonishment of both, not even the reduced end of the rod would enter the hole.

The head was laid by until it was cold, when it was refitted; the machinist having to remove over $\frac{1}{32}$ in. of stock in order to bring the diameter to the proper shrink allowance. When the head was again heated, this time in a proper manner, there was no further trouble with the shrinking and the fit was satisfactory.

Making Small Wheels for Internal Grinding

By John J. Bradley and R. S. Beaudford

In almost every shop, it is necessary to do some internal grinding, and often no small wheels are available for the job. The time necessary to send off and purchase the proper wheels would be too great. Small wheels can be easily and quickly made from broken wheels of thin section which are to be found around every shop.

A simple way to make a small wheel is to bore a hole in the broken piece the required size with a file, either by hand or by using a carpenter's brace to hold the file, and grind the piece to the required size on an ordinary grinding wheel.

The wheel so made can then be placed on an arbor and dressed with a diamond. Such a wheel compares favorably with the commercial product, and the time required to make it is almost less than it takes to tell how it is done.

Stamping Angle of Top Rake on Form Tools

By William Klinkow, Jr.

Many shops make a practice of grinding a definite degree of top rake on all circular, dovetailed and flat forming tools. The tool designer has a joyous time in figuring sines, cosines, tangents, etc., to allow for this rake and the toolmaker follows the drawings. If the calculations are correct and the toolmaker makes no mistakes, everything is lovely.

Then the tool gets dull from continued use and it is sent to the tool crib to be reground. The tool sharpener takes a squint at it with his "eagle eye" and grinds it to suit his own ideas. The tool goes back into service and trouble begins.

I would suggest that all such tools be stamped with the angle of top rake to which they are designed and, on circular tools, with the distance the edge is supposed to be below center. If the tool sharpener is required to observe these figures in regrinding the tool, a lot of trouble and useless argument will be eliminated.

It doesn't take a great deal of difference in the angle of top rake to bring about an appreciable variation from original sizes between steps, especially if the steps are large and the work is held to close tolerances.

Two Ways of Making a Core—Discussion

By F. C. Edwards
Birmingham, England

In an article under the above title by M. E. Duggan on page 735, Vol. 57, of the *American Machinist*, Mr. Duggan makes categorical statemnts on points which are distinctly debatable.

Broadly, in his attempt to vindicate the soundness of the method contained in his original article, he argues that so long as a certain foundry operation is *possible* or *practicable*, it should be allowed the same standing before the eyes of the young journeyman patternmaker as the best known method. Is not this almost tantamount to saying that it matters little if they learn the wrong way first, because, by experience—and at the expense of their employers, they will gradually grope

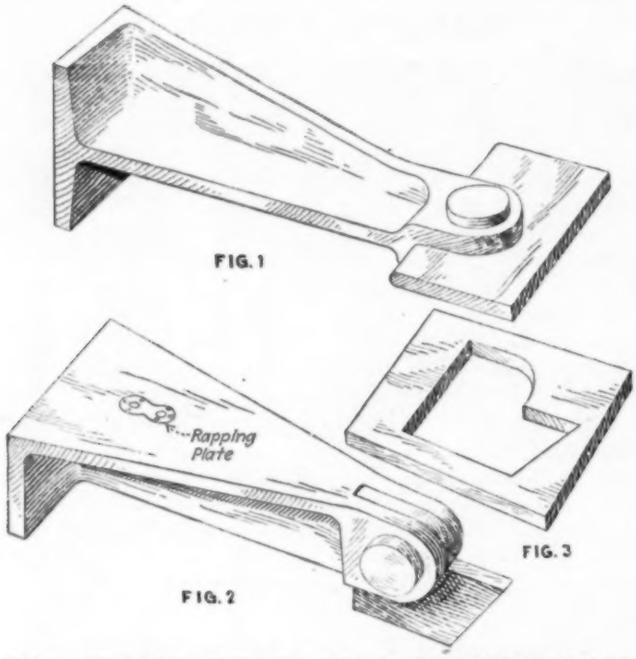


FIG. 1—ORIGINAL PATTERN. FIG. 2—NEW PATTERN AND CORE BOX. FIG. 3—CORE BOX FOR NEW PATTERN

their way to the right method? With good reason the old Greek professors charged double fees to the students who came to them with previous wrong training; for it is much more difficult to unlearn than to learn.

Leaving out of the question crude statements that are obviously intended to convey elementary notions of general principles (which is in accordance with Herbert Spencer's dictum that "Education should proceed from the general to the particular"), I submit that examples given for instruction should be based upon the best known practice in the particular kind of work dealt with. Further, if on reading an article in which a general writer illustrates a method far behind the times from a specialist's point of view, the specialist acts (according to the advice of Mr. Duggan) and passes it up, how is the best practice to get beyond the confines of the shop in which—after many costly experiments perhaps—it has been proved the best?

I am astounded at the assertion that "the word proper does not apply in the making of patterns, etc." And, since it may be taken too literally by those who are striving to acquire knowledge of foundry practice in the hope of perfecting themselves in the exercise of their craft, I must beg profoundly to differ.

As in every other field of human activity, molders may be found to express varying opinions on certain points, but there is general agreement among experienced craftsmen as to the best of several ways of making a job. It has been said that a noticeable effect of education is to reduce the differences existing between men on the fundamental points of life. Similarly with foundry practice, the greater the experience the less likelihood there is of differences of opinion. And when a specialist throws his concentrated light upon a subject, as P. W. Blake is criticized for doing, interested readers are enabled to add to their stock of tested knowledge, with the consequent dispelling of the mists of ignorance and the nearer approach to general agreement as to what constitutes best practice.

Again, Mr. Duggan denies that "the patternmaker predetermines the operations of the molder." This may be the case where the patternmaker is ignorant of foundry requirements. Certainly a joiner or a cabinetmaker could not be expected to predetermine these operations. But it is the primary business of the patternmaker to know—or if he does not know to inquire—what is the path of least resistance in the foundry for the particular job he is considering. Naturally, this "patternmaker's foundry sense"—as it has been called—takes years to develop. But, unquestionably, it can be developed, and it should be the constant endeavor of the patternmaker to acquire the foundry point of view.

Quite recently, a simple though typical case came to my notice, which will perhaps serve to illustrate this point. A number of castings were ordered from a pattern bearing a certain number. The pattern had been made some years previously, and was supposed to be still in existence. It could not be found, however, and a new one had to be made to replace it. This was made as shown in Fig. 2. Shortly afterwards the original pattern was found. This was made as shown in Fig. 1. Here, then, is a concrete case where the patternmaker predetermined the operation of the molder.

The pattern shown in Fig. 1 is "practicable," in fact, before the other pattern was made, a number of castings were made from it, molded as shown in the figure. But Fig. 2—also shown as molded—is a better method, since there is less of the mold to be lifted in the cope, and therefore there is not so much risk of mold disturbance or unsightly joints shown on the casting. Fig. 3 shows the corebox and is self-explanatory.

Handling Heavy Fixtures in the Shop

By John A. Yungwirth

I think that the majority of tool room foremen who have several milling machines under their charge have often been confronted with the old problem of how best to handle the dividing heads, vises, vertical attachments and other heavy fixtures that are used on such machines, and the storing of same when not in use. All toolmakers are familiar with the back-breaking task of lifting these heavy fixtures from floor to machine and back again, or from a stand beside the machine when no special hoist is provided.

In a tool room where I was employed some time ago, we facilitated the handling of these tools by building a substantial table or stand, approximately 36 in. square and 42 in. in height. The top we covered with metal to

allow the easy sliding of fixtures thereon, and fitted the legs with good casters, so that the stand could be readily moved to any part of the room. We then built a bench of exactly the same height as the portable table and of sufficient size to adequately accommodate all our heavy fixtures. This also was covered with a metal top and placed in a position easily accessible to all our milling machines.

With this equipment one man could handle the heaviest fixtures with ease and without undergoing any unnecessary strain. The portable table was moved alongside of the fixture bench, the two being of the same height, and the metal top allowed the tools to be slid to the portable table very readily. The table was then moved to the machine and the knee of the latter raised or lowered until the platen was on the same level when the fixture could be conveniently moved to the platen.

The advantages of this method, besides labor saving, are that the floor around machines is always kept free of all obstructions and looks neat and orderly, while at the same time the various fixtures are well taken care of, and are kept safe from any accidental injury when not in use. The portable table also comes in very handy when heavy dies or jigs are to be moved from work bench to machine and vice versa. The cost of making this equipment is nominal when compared to the cost of either a portable floor crane or hoist over each machine.

Two Pierce-Arrow Connecting Rod Gages

BY FRANK C. HUDSON

The two gages shown are used by the Pierce-Arrow Motor Car Co., Buffalo, N. Y., in inspecting the center

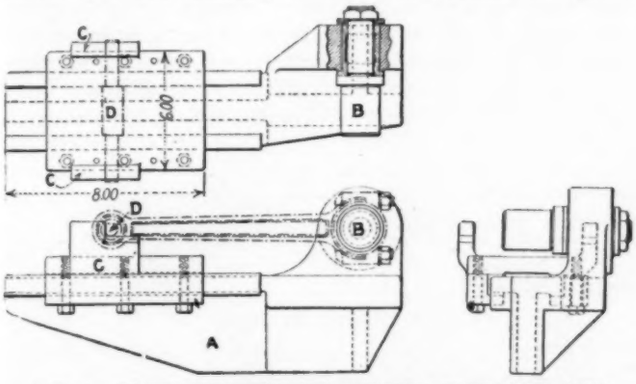


FIG. 1—GAGE FOR TESTING CENTER DISTANCE AND SQUARENESS OF HOLES

distance and squareness of the connecting rod holes and also the milling of the bolt bosses on the connecting rod cap. The gage shown in Fig. 1 consists of a substantial base *A* carrying a tool-steel, hardened and ground plug *B*, which is a close working fit for the large end of the connecting rod. At the other end of the fixture is a slide carrying the two projections shown at *CC*. This is made adjustable so as to allow it to be used for rods having different center distances.

The gage requires very little explanation as it is similar in its application to a number which are used for this purpose. This gage, however, combines at *C* the test for both parallelism of holes and their being square with each other. The standard testing bar *D* is a close working fit in the piston pin hole and as the bearing points on *C* are six inches apart, it shows a very small error without difficulty. Only the main dimensions are given in order that the general proportions may be easily seen.

The gage in Fig. 2 is more unusual as it tests the location of the bolt bosses on the connecting rod cap. It consists of the base *A* with the pin *B* for the small end of the rod and the flanged disk *C* which supports the large or crank pin end. The rod is held in place

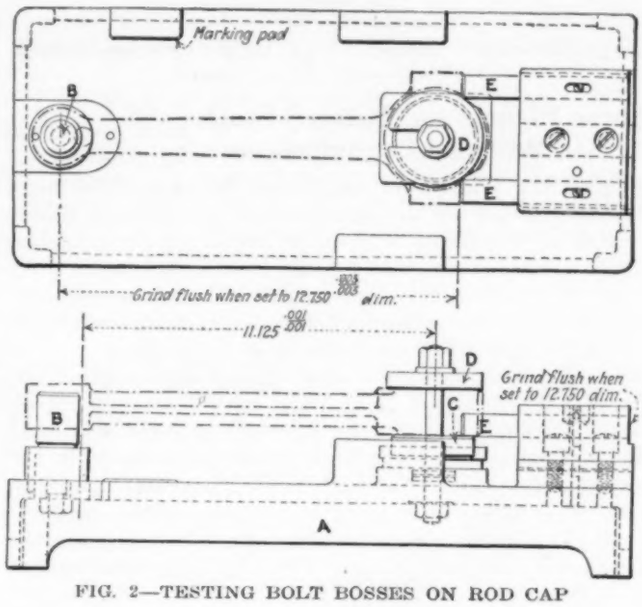


FIG. 2—TESTING BOLT BOSSES ON ROD CAP

by the open or slotted washer shown at *D*, while the bolt bosses are gaged by the two blocks *EE* shown in both views. The pad, shown on the main view, is for convenience in marking the gage for identification.

Pot Castings for Piston Rings

BY TOM H. BLAIR

I am reading with great interest the articles in the *American Machinist*, "What's wrong with the railroad shops?" [The fifth (last) article appeared in Vol. 58.]

I have a little kink on the design of pot castings from which piston rings are cut and it has been adopted by my employers. Nearly all pot castings are made with four lugs to be used in bolting to the table of a boring mill or the faceplate of a lathe. These lugs are of little use as the pots are generally held in a chuck. I had our pattern altered as shown in the sketch herewith and we undercut the chuck jaws to suit the angle at the bottom.

IMPROVEMENT IN POT CASTINGS

This arrangement saved lots of time in truing the pot when the rings were cut off in the lathe, as the chuck jaws could be slackened considerably without danger of the pot falling out. A web cast as shown at *A* was brought against one of the chuck jaws and prevented the pot from turning.

With pots made in this way, cuts as heavy as the machine will stand can be taken without danger of tearing the pot out of the chuck, and fully 20 per cent of the set-up time can be saved.

American Machinist
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KENNETH H. CONDIT AND FRED H. COLVIN
Editors
February 22, 1923

Some Figures on Watered Stock in Railroad Capitalization

ONE OF THE first arguments brought forth by a condemner of the railroads of the United States relates to the sinful amount of water in their capital stock. Without accurate figures to back his contentions their defender is hard put to refute the generalization because everyone knows of the bonus stock issued in the early days when the roads were being built.

In a recent address, George E. Roberts of the National City Bank of New York gave figures on stock watering that are interesting. He pointed out that most of the roads have been practically rebuilt in the last twenty years. So much money has been spent on them that the original stock issues are quite insignificant. If all the common stock issued by one big railroad prior to a reorganization twenty-five years ago had been water, it would be but four per cent of the present capital obligations. The deferred dividends for four years at six per cent on the stock sold at par since the reorganization would cover it.

On another trunk line road enough stock has been sold to the public at more than par for the premiums thus obtained to aggregate more than all the stock issued for any other consideration than cash.

There is no possibility of any watered value in the valuation surveys conducted by the I. C. C. Equities under this official valuation run from $133 to over $200 per share of common stock on such roads as the Santa Fé, Rock Island and Illinois Central.

When politicians and bureaucrats are willing to accept the result of expert investigations and stop following surmises and guesses in framing restrictive legislation, we may hope that the railroad managements will have a chance to raise the money they so urgently need for new equipment for their shops and for transportation.

Good Records of Shop Methods Are Valuable Possessions

NOTWITHSTANDING all that has been written and preached about the necessity of keeping records of shop operations, there are many shops where the only records existing are filed away in the heads of a few men. Some foreman has found a good way of doing some operation and both he and the management are happy, the management because the work is being done satisfactorily, and he because he has added to his stock in trade and has made himself more or less indispensable.

If his method is merely an improvement over an existing one, he feels that the company will be so many dollars poorer if he should leave, and if his find is an essential one, if it is the solution to a vexing problem, why then he has the company where he wants it. Whether the man actually feels this way or not makes no difference. His leaving would leave the company in a hole. The man himself may be an old and trusted employee and may have no thought whatever of leaving the company, and yet there will come a time when he does leave, for even foremen are mortal.

It is always possible to find a way to do some machining operation, may be not so economically or quickly as it might be done, but in some way. There are other operations which require some special knowledge, knowledge of mixing of materials, of temperature, of time of exposure to a bath or to heat, in short, knowledge which is not common, like ordinary shop practice, but which has been obtained by long experience and perhaps experimentation. Heat treating, annealing, polishing, japaning, lacquering, plating and other finishing operations belong to this class.

It is of the greatest importance to a concern to have the information relating to such operations in some permanent form so as to make the regular operation of the shop independent of the presence or absence of some man.

As soon as a satisfactory method is established, a record should be made and filed. When a better method is found the record should be altered or a new one made, and, as a rule, it is better to make an entirely new record, partly as a matter of history, partly because what seems an improvement at one time may prove, later on, to have some unsuspected disadvantages, compelling the shop to go back to the old one.

As to the man who discovers, or invents or improves a method he should be paid in some way, be it with higher wages, or a bonus, or royalty or with promotion. Should he insist on keeping his method as his personal property, then it is better to let him go and start all over again than to have the sword of Damocles hanging over the company with the certainty that it is going to fall some time—when the man dies.

Standard Sizes for Circulars and Catalogs

SEVERAL WEEKS ago in our "Just Suppose" corner we speculated on the possibility of saving time, trouble and money by reducing the number of sizes of catalogs. Apparently our thought has been in the minds of others for we received a letter shortly after the editorial appeared commending the idea and calling attention to the fact that over a dozen of the big electrical manufacturers have already adopted a size of eight by ten and one-half inches for their bulletins and catalogs. So large a percentage of the production of the electrical industry is controlled by this group that their action is tantamount to standardization of catalog size.

Our original intimation was that if twenty-five machinery manufacturers got together and decided on a standard size for their catalogs most of the others would follow suit and another elimination of waste would be accomplished. Why not take a tip from the electric fellows and get together on this business?

Shop Equipment News

Heald Hydraulically Operated Internal Grinding Machine

The Heald Machine Co., Worcester, Mass., has just placed on the market the No. 72 internal grinding machine, which is of the same work size and capacity as the No. 70, but is equipped with the Heald hydraulically operated table movement as well as with several other new devices calculated to enhance the speed and accuracy of production. The driving gears and speed change boxes are eliminated so that except for the oil pump, which is of the geared type, there is no toothed gearing of any kind in the machine.

The headstock of this machine is the same as upon the No. 70, and is driven by a belt from an overhead countershaft provided with five-step cone pulleys for changing the rotative speed of the work. The starting lever extends through a slot in the cover, which encloses all moving parts of the head except the spindle nose. A movement of this lever to the left throws a clutch into engagement with the constantly running driving pulley and starts the work, while a reverse movement withdraws the clutch and automatically applies a brake for stopping the rotation quickly.

The table movement is controlled entirely by the two small levers shown in Fig. 1 upon the front of the machine base. The upper lever with the ball handle is the reversing lever, determining by its position the direction of the table movement, and may be thrown from one extreme position to the other at any time. A spring actuated device prevents it from stopping in mid-position.

The lower lever is the throttle and speed control. With this lever at the extreme right position the throttle is closed and the table is at rest. Moving the lever to the left until the latch engages the first notch of the quadrant starts the table at a speed of 2 in. per min., at which speed it continues to traverse indefinitely under control of the reversing dogs. The speed is uniform in either direction and there is no hesitation at the point of reversal.

Advancing the throttle lever to the left increases the speed of table traverse by suitable increments until at the extreme left position of the lever the table is traversing at a speed of 36 ft. per minute. The movement of the throttle lever from closed position to full traverse speed may be made instantly without detriment to the machine. In practice the operator predetermines the speed at which he desires the table to traverse, and then each time he starts the table movement he merely moves the throttle lever at once to the corresponding notch of the quadrant.

FIG. 2—DIAMOND TRUING AND SIZING DEVICE

The point of automatic reversal is determined by easily adjustable dogs upon the front of the table. If, for any reason, the operator desires to over-run the table in either direction he merely draws the ball handle of the reversing lever toward him for a distance of about 2 in., at which time the automatic reverse is out of action without disturbing the functions of the lever itself. The table will then move to the extreme position and remain there (without the necessity of closing the throttle) until the lever is thrown in the opposite direction by the hand of the operator.

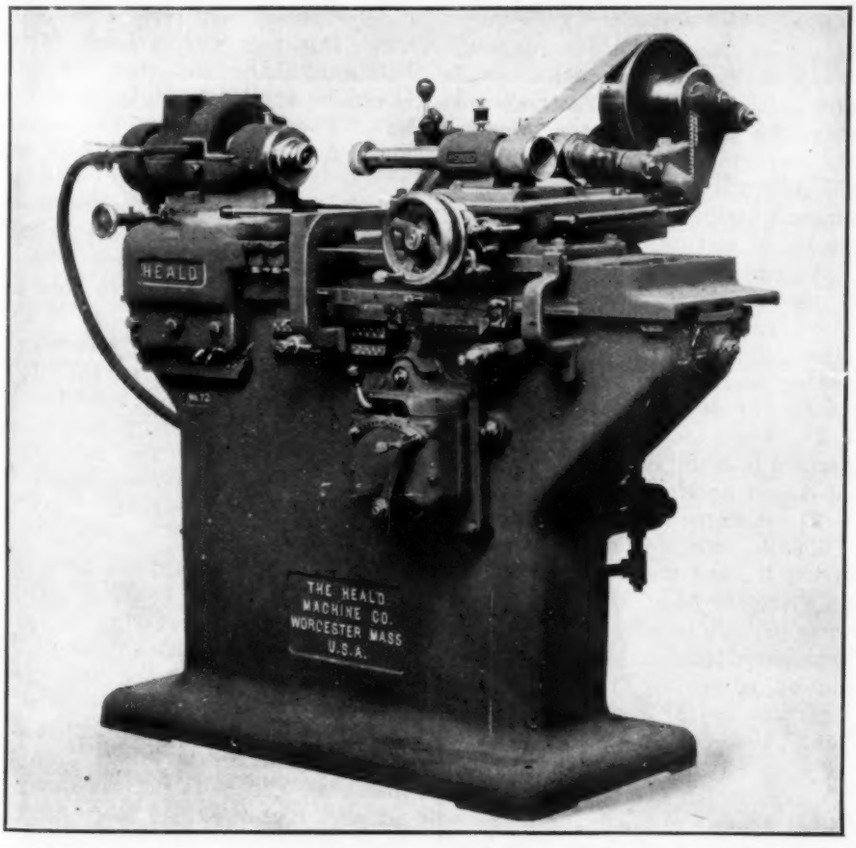


FIG. 1—HEALD HYDRAULICALLY OPERATED INTERNAL GRINDING MACHINE

Upon this action the table will return automatically to the control of the reversing dogs.

An outstanding feature of the hydraulic drive is the fact that if, by any contingency, the table should come in contact with an obstacle, as by the accidental dropping of a piece of work in its path, it will merely stop against the obstacle and remain at rest until the operator throws over the reversing lever to withdraw it. An accident of this kind, which would surely wreck the driving mechanism of a gear-driven machine, does no damage whatever.

The crossfeed of the wheelhead is equipped with the usual automatic sizing features, and in addition is provided with a positive adjustable stop by means of which the operator is enabled to withdraw the wheel at any time and return it to the cutting position quickly, without careful attention to verniers or other measuring devices, and still be sure that the original setting has not been disturbed.

In Fig. 2 may be seen the diamond truing device which has been developed in conjunction with this machine, but which has been so designed as to be applicable to all similar machines, including the gear-driven machines of the Heald line. This device is attached to the machine in such a way that it may remain in position without interfering with the work in progress. The lever upon the end of which the diamond is mounted has a swinging movement of about 45 deg. in a vertical plane parallel to the axis of the work, and is moved by means of the ball handle. As shown in the illustrations, it is in the upper, or "out" position, but is still in the same vertical plane as the active part of the periphery of the grinding wheel; though above it.

To true the grinding wheel the operator moves the lever to a horizontal position, when the point of the diamond is then in exact line with the surface of the work being ground, and traverses the wheel before it. As the distance from the diamond to the axis of rotation of the work is equal to the finished radius of the hole to be ground, this device serves as an effectual safeguard against oversizing a hole. The active portion of the periphery of the grinding wheel cannot be set too far out, as in so doing the wheel itself would be turned off by the diamond.

Ordinarily the diamond would be left in the lower, or "active" position; the only reason for providing the swinging movement is to raise the diamond out of the path of the larger wheelheads without disturbing its radial setting.

An end view of the machine, Fig. 3, shows the features of the automatic sizing mechanism, the construction and setting of the diamond truing and sizing device, and also shows the details of the belt tightener, which has already been described in detail on page 275, Vol. 58, of *American Machinist*.

The machine weighs approximately 4,500 lb., occupies a floor space of 6½x3½ ft., and the work spindle is 46 in. from the floor. The work spindle runs in plain parallel bronze bearings in tapered draw-in sleeves with ring nut adjustments. The front and rear bearings are 2¾ and 2¼ in. in diameter, respectively. The workhead will swing 12 in. inside the water guards, which are not shown in the illustrations, and the machine will grind holes 11 in. deep. The workhead swivels 45 deg. either way and is graduated both in degrees and inches of taper per foot. The speed of the countershaft is 600 r.p.m.

The tank for the oil used in the hydraulic mechanism is cored within the base and has but two openings, one of which is closed by the cover that carries the pump and fittings, while the other is closed by a plain cover which may be removed for the purpose of cleaning the tank. Both covers are set on gaskets and must be tight under oil pressure, so there is positively no way in which dirt, water or grinding compound can get into the hydraulic cylinder. All pipes and connections are exposed at the rear of the machine to make them easily accessible.

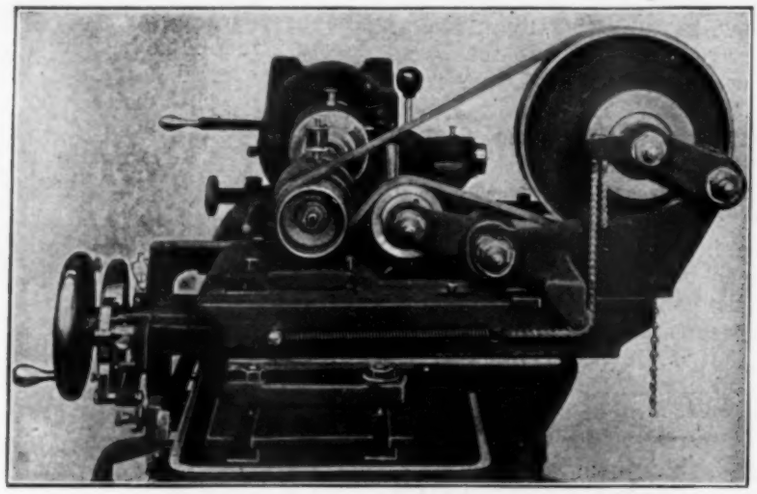


FIG. 3—END VIEW OF HEALD MACHINE

Monarch Pulley Covering

As a means of reducing the slippage of belts on pulleys, a pulley covering has recently been developed and placed on the market by the Monarch Belting Co., 1270 Ontario St., Cleveland, Ohio. The covering consists of a specially manufactured duck that is treated with a preservative material, and then cemented to the face of the pulley by a special cement furnished by the concern.

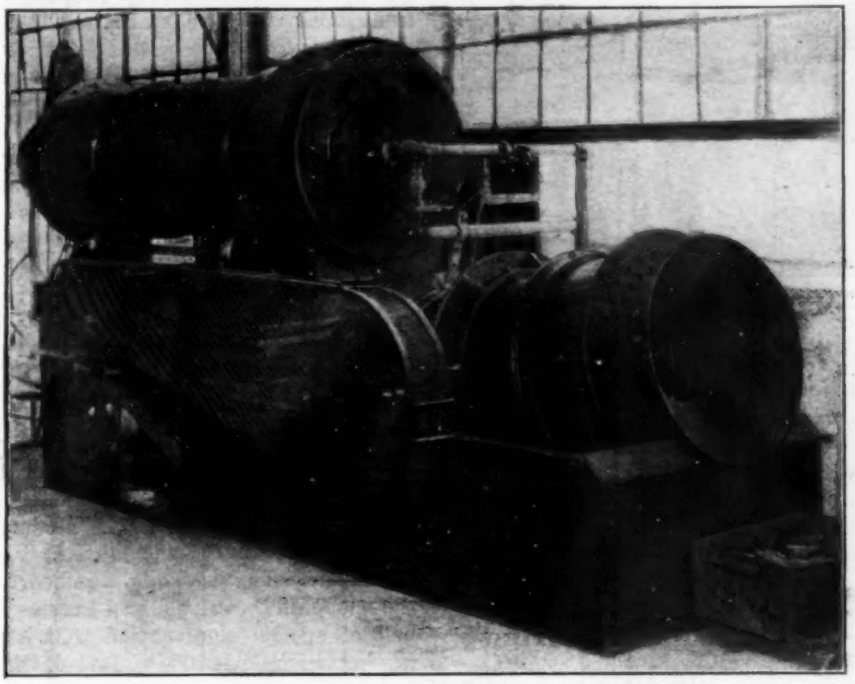
The covering can be furnished in the size necessary and can be cut to fit the pulley. It is laid on in a single thickness with a closely fitting butt joint at the junction of the ends. It can be applied to all types of pulleys. For metal pulleys the surface must first be cleaned of dirt and grease and then washed with sal soda solution. Wooden pulleys are sand-papered or scraped with a rasp to give a clean surface.

The cement is applied to both the pulley and the covering. It is used cold and furnishes a very secure grip. It hardens overnight, so that it is not necessary to keep a machine out of use for an extended period to apply the covering. The cement is suitable for use when cementing cloth disks on metal wheels of disk grinders and similar machines.

No non-slip preparations are placed on the belt, as the friction between the belt and the covering is large, and tends to minimize slippage. The covering can be cleaned with gasoline should it become filled with oil or dirt. The covering can be applied while the pulley is in place on the machine, and it is not necessary to employ highly skilled labor for the application.

Rockwell Automatic Rotary Quenching Tank

A rotary quenching tank, the design of which is based upon the principle of the Rockwell rotary furnace, has recently been developed for use when heat-treating small parts in large quantities. In the accompanying illustration, the tank, which is a recent product of the W. S. Rockwell Co., 50 Church St., New York, N. Y., is shown mounted with an automatic rotary furnace. The apparatus gives automatic treatment of material that is of such size and shape as to permit of rotation in the cooling process.



ROCKWELL AUTOMATIC ROTARY QUENCHING TANK COUPLED TO ROTARY FURNACE.

After the material being treated has been slowly brought up to temperature and discharged from the furnace, it slides quickly into the submerged end of the quenching tank. Here it is automatically picked up in small batches by the internal thread of the rotating tank and conveyed through the quenching fluid by the Archimedes screw as it is raised to the cone-shaped discharge spout that an be seen at the front. The quenching fluid flows through both the outer tank and the rotating tank, and its depth may be governed by an adjustable outlet. The continuous movement of the material in the circulating fluid insures uniform cooling.

The rotary tank may be operated directly from the furnace or by an independent drive with an individual control. The unit illustrated makes a very effective automatic heating and cooling installation. Each piece of the work is given individual treatment and is continuously traveling through the heating and cooling operations.

The cost of production of the work should be low, due to the economy of labor, time, fuel and floor space, and the small percentage of rejections. It should be noted that the only labor required is that for supervision, thus eliminating to a great extent the human element in the treatment. Each piece is automatically cooled in the same manner, for the same length of time and at the required temperature.

The quenching tank is made in two sizes, the larger one being 8 ft. long, 6 ft. wide and 4 ft. 6 in. in height, and the smaller one 6 x 4 x 3 ft. 6 inches.

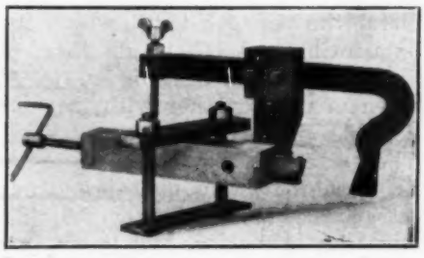
Reliable Machine Works Cutting-Off Toolholder

The Oddsen toolholder that is shown in the accompanying illustration has recently been placed on the market by the Reliable Machine Works, 42 Sixteenth St., Brooklyn, N. Y. The holder is intended for use on a lathe when cutting-off round stock, and it is adapted to both toolroom and production work where the machines are not made particularly for cutting-off operations. It is of especial use when cutting short lengths of bar stock or pipe.

The chief feature of the device is the fact that the work is supported by the V's that are attached to the toolholder. In this way, the relation between the work and the cutting tool is maintained, and the toolholder performs the function of a steadyrest. It supports the work closer to the tool than can be done with a steadyrest, it is always in the proper relation with the tool, and need not be moved when cuts are taken at different positions.

The body of the tool consists of a bar 1½ in. square and 8 in. long, in which a cylindrical member is arranged to slide by the operation of the ⅜-in. screw at the rear end of the bar. The inner member has a travel of 2½ in. and carries the cutting-off tool, which is of the standard ¼x⅜ in. size. The small hole shown in the side of the bar is provided to enable tightening the setscrew that holds the tool in place.

The work-steadying member is adjustable to take diameters up to 5 in. It can be adjusted to the size of the tool and then clamped in place by the setscrews and by the thumbscrew at its rear end, which latter screw furnishes support. A vertical movement of ¼ in. is provided for the whole work clamping member,



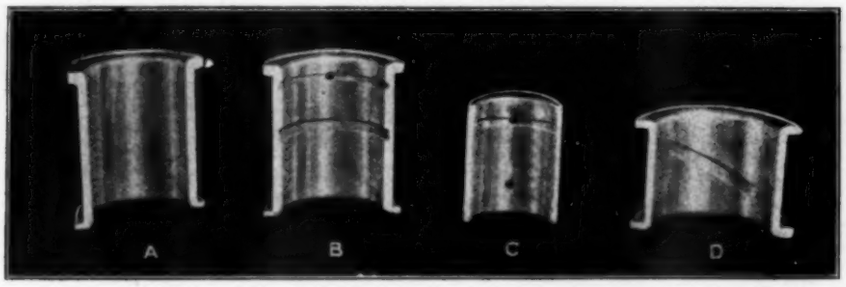
RELIABLE MACHINE WORKS CUTTING-OFF TOOLHOLDER

so that the height of the tool can be held level with the center of the work as the edge of the tool is ground down. The holder is secured to the toolpost of the lathe by a clamp.

It is claimed for the tool that chatter and vibration are greatly reduced, and that the time of the cutting operation can be diminished. Tool breakage is also diminished, and the tool can be used until it has become worn short. It should be noted that the tool is always fed by hand, and that the cross slide of the lathe is locked in position.

Chadwick Bearings

Believing that engineering principles which have proved successful in the building of internal combustion motors can be successfully applied to the building of other kinds of machinery, the General Aluminum & Brass Co., Detroit, Mich., has placed on the market a bearing known as the Chadwick bearing. This bearing is the result of extensive experiments that were conducted in the process of developing a suitable bearing for the Liberty airplane motor, to meet the necessity for a uniformly dependable bearing with properties and dimensions hitherto considered impossible. Every mechanical and metallurgical requirement of a bearing was considered in logical sequence, and the defects in each step of manufacture eliminated.



CHADWICK BEARINGS; (A) TRUCK BEARING, UPPER HALF, (B) LOWER HALF, (C) OAKLAND MOTOR MAIN BEARING, (D) MARINE MOTOR BEARING

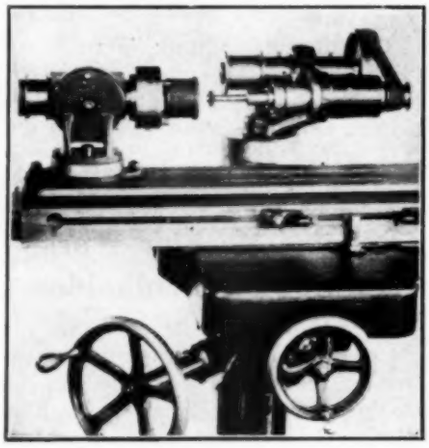
The bearing consists of a bronze back with a lining of babbitt, bonded together with a thin bond of pure tin. Bronze has, more than any other metal, the strength to withstand the hammering and effects of vibration to which the bearing is subjected when in use, together with the best possible heat-conducting qualities. The value of the babbitt lining lies in its anti-friction qualities, which lessen the danger of overheating. Also, due to the fact that its melting point is low, it allows the metal to melt and flow when overheated. This property eliminates the possibility of sudden seizure of the shaft and the consequent danger of distortion or rupture of other parts of the machine. The babbitt is put through a process which increases the tensile strength 50 per cent and reduces friction 14 per cent, as compared with the same metal when made by the ordinary process.

The construction of the bearing and the fact that the bearing surfaces are held within 0.00025 in. of specified dimensions make the bearings interchangeable. It is, however, necessary that the journal bearing be bored to close limits so as to provide a perfect seat for the bearing surfaces. The bearing surface is made perfectly round; that is, with a high degree of accuracy, which feature insures complete support for the journal and the full contact to aid heat conductivity.

The bearing surface is finely burnished and is so accurate that any reaming, running-in or hand scraping is not only superfluous, but would ruin the bearing surface. This extreme accuracy makes possible the maintaining of a perfect film of oil around the shaft. A bearing in a motor or machine can be replaced in a few minutes, the only labor required being that necessary to remove the old bearing and set the new one in place.

Woods Internal Grinding Head

A head for doing internal grinding, and that can be applied to either the No. 2 or the No. 2½ universal tool and cutter grinder made by the Woods Engineering Co., Alliance, Ohio, has recently been placed on the market by this concern. In the illustration, the head is shown fitted to a No. 2 machine employing the regular work-holding head, which can carry either a chuck or a faceplate.



WOODS INTERNAL GRINDING HEAD ON CUTTER GRINDER

The head is suitable for production on internal grinding work, but is adapted to places where the amount of grinding does not warrant the buying of a single-purpose machine. The attachment is complete in itself and replaces the regular grinding head supplied with the machine. It is mounted directly on the column of the machine, and the change requires only about five minutes to make.

The shaft driven from the overhead lineshaft is mounted on ball bearings and carries a large pulley that drives the spindle. The spindle is mounted on four rows of ball bearings and has provision for adjustment. The spindle nose is arranged for mounting different lengths and diameters of stubs to suit the work at hand. An adjustment is provided for keeping the proper tension on the short belt driving the spindle.

Medart Safety Cupola Tapper and Stopper

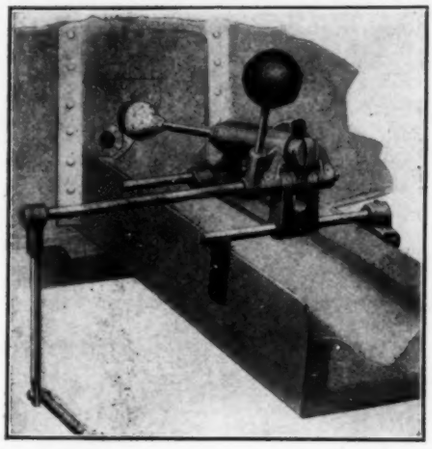
A device for easily and accurately controlling the flow of molten metal from a cupola in a foundry has recently been developed by the Medart Co., Potomac and DeKalb Sts., St. Louis, Mo. The device is attached to the spout of the cupola and carries a ball of special composition that fits in the tap hole in the breast of the cupola to stop the flow of the metal. Opening and closing the tap hole is accomplished by moving the lever at the left. A rod can be attached so that control can be obtained at a relatively great distance from the cupola.

The ability to start and stop the flow instantly and positively is probably the chief feature of the device. Also, the safety of the operator and of the workmen around the cupola is considerably enhanced. The danger from an overflowing ladle due to the loss of the ball of clay from a clay-tipped rod is not present, as the tap hole can always be stopped up. If necessary, the flow can be resumed again almost immediately after it has stopped, without the necessity of waiting for the clay-butt to dry, as with the method usually employed.

The device is attached by means of lugs on the right side of the spout, as shown in the accompanying illustration. There is another lug on the left side for supporting the shaft that extends across the spout. Since the device is hinged to the lugs on the right, it can be lifted and swung

to one side so as to leave the spout absolutely clear.

The breast of the cupola is filled with fire clay in the manner ordinarily employed and is then given the impression of the ball on the tapping device while the clay is still moist. Since the ball itself is of a composition to withstand the heat, it is not necessary to renew it each time that the furnace is tapped, but it should last for four to six heats. Extra balls that are interchangeable can be furnished. They are so arranged as to be bolted into position on the end



MEDART CUPOLA TAPPER AND STOPPER

of the piston rod, after which the bolt head and the threaded portions are covered with fire clay to prevent them from being damaged by the heat.

The link mechanism connected with the operating lever is such as both to raise and to draw back the piston rod when the cupola is to be tapped. The counterweight serves to hold the ball in either the open or the closed position. Adjustment of the position of the ball vertically can be obtained by means of a setscrew in the mechanism.

Brown & Sharpe 6-Inch Stainless Steel Rule

The 6-in. or pocket-size mechanics' rule No. 350 that is illustrated is made of stainless steel and has recently been placed on the market by the Brown & Sharpe Manufacturing Co., Providence, R. I. The steel from which the rule is made is of such nature that it will not stain, discolor nor rust.

The rule is furnished with scales graduated in eighths, sixteenths, thirty-secondths and sixty-fourths of an inch. Even where the graduations are close together, they can be more easily read than on the ordinary rule, because of the fact that the rule always has a bright finish and does not become rusty nor blackened from use.

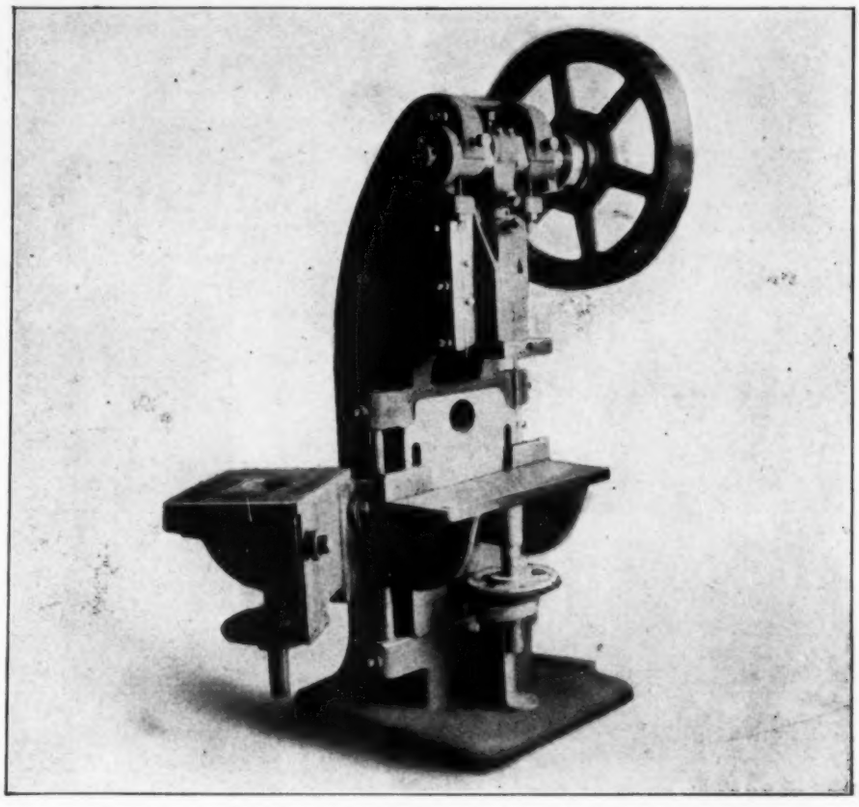
BROWN & SHARPE 6-INCH STAINLESS STEEL RULE

Adriance Horning and Wiring Press With Two Beds

An arrangement for facilitating press work where two sets of dies of different types are required for the work, is shown in the accompanying illustration, which represents a No. 25 horning and wiring press equipped with two adjustable swinging beds. The machine has recently been placed on the market by the Adriance Machine Works, Inc., 80 Richards St., Brooklyn, N. Y., as an addition to the standard line of such presses.

The construction is of particular use when manufacturing parts such as wash boilers, or in wiring work where a bolster is required. One set of dies can be swung out of the way while the other is in use, although it is conveniently available when it is required. In this way, it is not necessary to handle the dies and to change the bed when the new die and a different height of bed are required. It should be noted that the height of each bed can be adjusted by means of the screw. The usual style of clamping bolt is employed for securing the bed to the column.

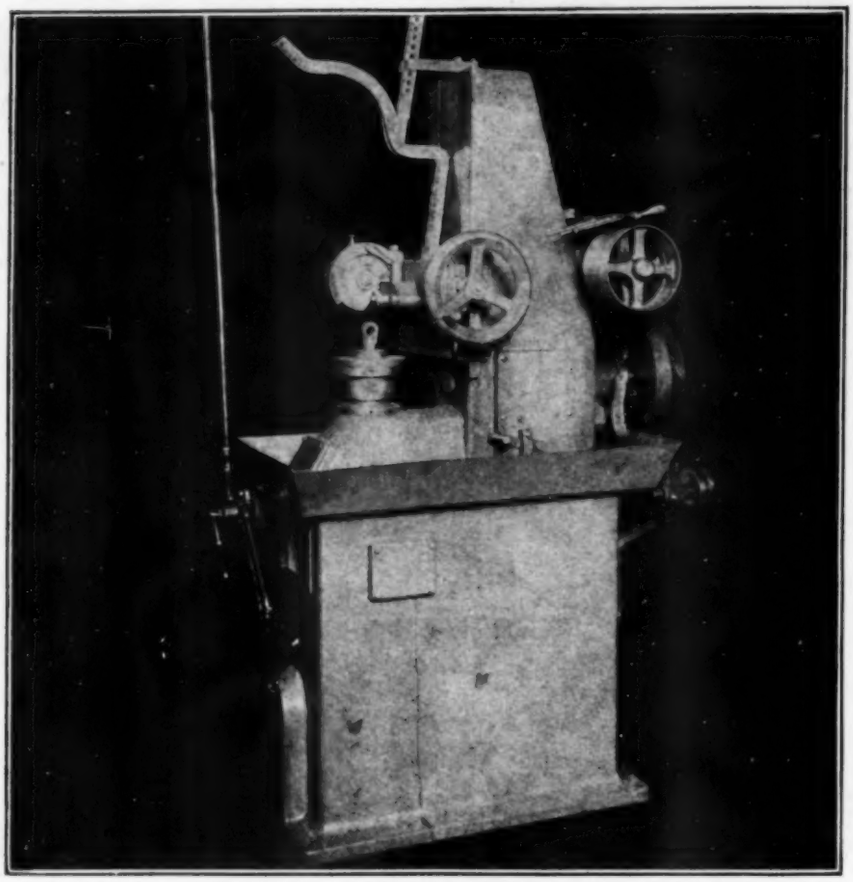
The press itself is similar to the line of horning and wiring presses made by the concern, and it is adaptable also to a variety of operations such as cutting, blanking and forming. The No. 25 machine that is illustrated can handle diameters up to 14 in. and depths up to 17 in., and it will cut blanks up to 8 in. in diameter. The standard stroke of the slide is 3 in., and the maximum 5½ in. The table has a hole 8¼ in. in diameter. The plain machine has a floor space of 48 x 39 in. and a weight of 5,100 pounds. The weight for foreign shipment is about 5,800 pounds.



ADRIANCE HORNING AND WIRING PRESS WITH TWO BEDS

Zimmerman Vertical Piston Lathe

The Production Machinery Co., Inc., Main & Horton Sts., Jackson, Mich., has recently brought out the Zimmerman vertical lathe. The machine is intended especially for work on pistons, but can be employed for operations on such work as fan pulleys and wheel hubs. In the accompanying illustration it is shown equipped for taking a finishing cut on the head of the piston with a tool, and then passing an abrasive wheel over the head to give it a highly finished surface. It is stated that this arrangement, employing both a cutting tool and an abrasive wheel on the same machine, can be applied to other operations on pistons and similar work.



ZIMMERMAN VERTICAL PISTON LATHE

Although the machine as illustrated is for finishing the ends of the pistons only, it can be adapted for performing other operations, such as boring and facing the open end of the piston, turning, rough facing the head, roughing and finishing the ring grooves and finish turning the outside.

All the mechanism for the operation of the machine is contained in one unit in the upper portion. The mechanism for changing the speed and feed, the clutches, spindle and driving parts are in the upper column, which can be removed from the pedestal just below the chip pan. Where it is desired, a number of heads can be mounted on one base to effect a considerable saving in floor space. Each head, of course, is then operated individually and independently of the other heads.

For the operation shown in the illustration, a high-speed tool bit is mounted in the toolholder, so that when the handwheel is turned the tool is fed across the top of the piston to take the finish facing cut. Means are provided for clearing the tool from the work on the return feed. The grinding wheel, which cuts on the same plane as the cutting tool, then is brought into operation and removes a small amount of stock from the head of the piston. The feed is entirely by hand, and no power traverse is employed. Due to the small amount of motion, however, the hand feed is very rapid.

By pulling down on the lever shown above the machine, the tool and the wheel can be lifted away from the piston to provide clearance for the operator when taking off or putting on another piece of work. The piston is held down by an air chuck that is mounted on the lower end of the spindle.

The cross slide is provided with a roller that follows a templet, so that crown-head pistons may be faced. When the top of the piston is flat, a straight slide is employed instead of one having a convex or concave surface to conform to the head of the piston being machined.

The machine can be provided with six changes of speed, two of them being obtained by a double friction clutch to give a high and a low speed engaged by the same lever. Three more speed changes are provided by a three-step sliding gear.

When a power feed mechanism is provided, a feed unit with six changes of both vertical and cross feed can be mounted. It can be arranged to give values of feed in either inches per minute or thousandths of an inch per revolution of the spindle.

The machine can be used for boring and turning work up to 14 in. long by 10 in. in diameter, and it will swing 14½ in. The spindle nose that carries the work is provided with a thread for holding a faceplate, chuck or other work-holding device. The spindle has a 1⅝ in. hole through it, and its lower end is arranged to carry an air chuck, where such a chuck is required.

The toolholder accommodates a ⅝-in. square tool bit, and is so arranged that it can carry either forged tools or the standard toolholder. The abrasive wheel ordinarily employed is 6 in. in diameter, ¾ in. thick, grade 46-L, and runs at 2,800 r.p.m.

The machine may be driven either by belt from the lineshaft, or directly from a motor through a silent chain. It requires about 3 hp. All the main bearings of the machine are lubricated from a single oil storage tank having a capacity of about one quart and mounted inside the column. Constant lubrication is thus obtained, without the need of frequent attention from the operator. A coolant system can be supplied for installations where it is necessary.

The single-spindle machine requires a floor space of about 24x48 in. When four spindles are mounted on one base, the floor space is only 84x48 in. The single-spindle machine weighs about 2,400 lb. net, and about 2,600 lb. when crated.

News Section

American Tools to Have Place in Permanent Exhibit at Prague

On Wednesday, Feb. 14, further steps were taken to forward the plans to introduce American tools into Czecho-Slovakia as announced exclusively in the *American Machinist* for Jan. 18. At a meeting at the Hotel Belmont, New York, it was decided to place a permanent exhibit of American tools in the Masaryk Academy of Labor at Prague. Those present at the meeting which was called by Frank B. Gilbreth, were Dr. Alois Z Stangler, Commercial Counsellor, Czecho-Slovak Legation, Bozetech Sula, an engineer of Prague, Dr. Jaroslav A. Michal, research engineer of the General Chemical Co., Calvin W. Rice, Secretary of the A.S.M.E., and Kenneth H. Condit, editor, *American Machinist*.

The New York offices of the Stanley Rule & Level Co., Henry Disston & Sons, Inc., and the Greenfield Tap & Die Corp., were visited and the tools made by these companies inspected. Mr. Sula will visit the shops of the companies who are to contribute tools for the exhibit so as to prepare himself to explain their fine points to his countrymen at the exhibit at the Masaryk Academy. He expects to return to Czecho-Slavakia in March.

Dr. Stangler will handle details in the United States from the Czecho-Slovak legation, 2040 S St., N. W., Washington, D. C. It is not the intention of the committee in charge to exhibit tools which would compete with local products. They contend that it would be a waste of money and effort to do so because of the adverse exchange situation. Their purpose is to show tools that cannot be had in Czecho-Slovakia so that their artisans can learn their use. It is expected that orders to American manufacturers will follow.

Amount Lost in Wages By Strikes

In the annual report of Will J. Tracy, chief of the Pennsylvania State Bureau of Mediation and Arbitration, 389,000 persons were involved in strikes during 1922 and it is estimated that $208,000,000 was the amount lost in wages alone. During the year, there were 1,807 strikes in the state, the anthracite and bituminous strikes being of the largest proportions.

Spring Makers in Big Merger

A merger of spring manufacturers was recently effected by which five of the largest makers of this product in the United States have been united and henceforth will act as units in the new corporation. The Wallace Barnes Co., Bristol, Conn., the William D. Gibson Co., Chicago, Ill., the Raymond Manufacturing Co., Corry, Pa., Barnes-Gibson-Raymond, Inc., Detroit, Mich., and the Wallace Barnes Co., Hamilton, Ont. are the companies that have been joined togther under the name of the Associated Spring Corporation of New York. No change in the personnel or policy of any of the companies will be made.

English Authority on Metals Speaking Here

Dr. Walter Rosenhain, head of the metallurgical department of the National Physical Laboratory at Teddington, England, is in America under the auspices of the Federated American Engineering Societies. He is scheduled to speak before the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, at Lehigh University, at Franklin Institute, at Philadelphia, Columbia University, Yale University, Production Club of Waterbury, Conn., and many other places. The dates extend from February 15 up until April 5.

Metal Trades to Meet in April

The twenty-fifth annual convention of the National Metal Trades Association will be held at the Hotel Astor, New York City, on April 18 and 19. Prior to the meeting of the national body, the local New York branch will hold sessions on April 16 and 17. A program of exceptionally wide scope has been arranged by the association and sufficient entertainment has also been provided for during the hours when sessions are not in progress.

Pennsylvania Orders Engines

The Pennsylvania Railroad has just placed an order for 275 locomotives to be delivered before Nov. 1, with the Baldwin Locomotive Works. Since Jan. 1 the Pennsylvania has ordered more than 500 engines of various types. An order for 100 heavy engines placed with the Baldwin Works last August by the Railroad is just being completed.

A.I.E.E. Holds Mid-Winter Meetings

The mid-winter meetings of the American Institute of Electrical Engineers were held at the Engineering Societies' Building, New York City, on February 14 to 17 and were attended by approximately 1,200 engineers from all parts of the country. Interesting sessions were held during both the mornings and afternoons of the days of the convention and on Thursday noon a tour of inspection through the plant of the McGraw-Hill Co., Inc., was enjoyed. Every part of the building was visited under the guidance of editors from various McGraw-Hill technical publications. A dinner-dance was enjoyed on Friday evening at the Hotel Astor.

Railroads Show 5.15 Per Cent Earnings in December Report States

By the recent report of the Interstate Commerce Commission, it is shown that during the month of December Class 1 railroads had a total operating income of $79,154,900, equivalent to an adjusted annual return of 5.15 per cent on the tentative value of the carriers. During December 1921 the percentage was only 3.23. In November 1922 the net operating income was $78,869,500, which represented a return on an annual basis of 4.46 per cent on the tentative valuation.

The December earnings are the highest for any year during the same month in some time. Industrial activity is given as the main reason for the business, although in some parts of the country a congestion of traffic due to strikes sent business into the month of December and also into this year and up to the present time. Operating expenses during December increased 15.2 per cent, while revenues were raised 20 per cent.

Safety Council to Meet in Buffalo

Buffalo has been chosen as the meeting place for the National Safety Congress to be held Oct. 1 to 5 at the new Hotel Statler, according to the announcement recently made by W. H. Cameron, managing director for the executive committee of the National Safety Council. This year's meeting will be the twentieth annual convention and it is expected that the attendance will be greater than at any of the previous meetings.

Dissolution of Walcott Lathe Company

A notice has been issued by the Circuit Court of Jackson County, Michigan, asking that all persons interested be present in the Court of Chancery, at Jackson, Mich., on March 26 to show cause why the Walcott Lathe Co. should not be dissolved. The company voluntarily filed a petition and Dean G. Kimball, vice president and general manager was appointed receiver. The financial complications arose from a judgment which was recently obtained against the Walcott Lathe Co. for $103,000 on a breach of contract action.

Record Steel Producing Month

By the recent report of the American Iron & Steel Institute, the production of steel ingots during the month of January is estimated at 3,700,000 tons. This was the largest amount which has been produced since March, 1920. It is expected that the output during the month of February will be even greater than January, although the shortness of the month may defeat this record.

News of Washington Activities

By Paul Wooton

A new bill which represents majority sentiment among the members of the House interstate commerce committee has been introduced to provide for the return by the Alien Property Custodian of certain trusts held by him under the trading with the enemy act. This measure will displace the one on the same subject which has been considered by the committee several months.

The revised bill, broadly speaking, provides for the return of trusts valued at less than $10,000, but no more than that maximum amount shall be returned to any one person regardless of the number of trusts in which he may possess an interest. A new provision is written in this bill stipulating that after its enactment dividends and interest on trusts still held shall be paid to the one for whom the trust is retained.

Exceptions to the bill are patents, trade-marks and copyrights which have been "sold, licensed or otherwise disposed of" or which are involved in litigation "in which the United States, or any agency thereof, is a party." This exception excludes from the provisions of the bill all the patents given into custody of the Chemical Foundation, Inc., and all licenses under these patents and the patents previously issued by the War Trade Board, and also excludes various patents held by the War Department and the Navy Department.

The bill would give the right to persons and associations not citizens of Germany or Austria-Hungary, whose property is held, to apply for return, which may be granted by the Presidest. It also affords relief for stockholders of corporations or associations whose property may be held when 50 per cent or more of the stock is owned by other than citizens of Germany or Austria-Hungary.

No estimate has yet been prepared of the full effect of this bill as revised. Testimony before the committee by Alien Property Custodian Miller showed that there are 28,144 trusts held by that official valued at $10,000 or less each, the return of which would involve $22,122,002, leaving still in custody 2,224 trusts valued at $296,235,899.

New Secretary for Dock Operators

Wayne Ellis has been selected for the secretaryship of the Northerwestern Dock Operators' Association. He was selected for this important position because the dock operators are convinced that he has as thorough knowledge of coal distribution as is possessed by any coal specialist in the country. The appointment became effective February 5, but Mr. Ellis was not able to undertake his duties on that date, due to the necessity of concluding some of the work he has under way for the President's Coal Commission.

Overcoming Fuel Shortage in South

In an effort to meet the shortage of domestic fuel in the South, the Interstate Commerce Commission has issued Service Order 38, which probably will be followed by similar orders, instructing the Southern Railway Company to assign fifteen cars per working day to the mine of the Montevallo Co., Aldrich, Ala. The order is to be in effect until March 5. It provides, however, that not more than 20 per cent of the amount shipped on any day is to be sold for use for other than domestic purposes. The cars assigned under this order are not to be counted against the distributive share of the mine.

Dictaphone Company Now Separately Operated

The dictaphone department of the Columbia Graphophone Co., has been set up as a separate business having been purchased by a group of bankers. No change in the policy of the company or in the location of its many branch offices will be effected, it is announced. C. K. Woodbridge, who has been for the past five years at the head of the dictaphone department, will be the president of the new company, Richard H. Swartwout will be the chairman of the board of directors and L. C. Stowell will be secretary and assistant to the president. The following directors have been chosen: Richard H. Swartwout, George A. Ball, Marsden J. Perry, R. J. Scoles, Paul Appenzellar, H. R. Swartz, J. Russell Clarke, C. K. Woodbridge and Alfred C. Andrews. All of these men are exceptionally well known in manufacturing lines and financial circles.

Excellent Condition of Iron and Steel Industry

That the iron and steel industry is in a better condition than for some time past is shown by the recent special report which is made by *Dun's Review*. This report is compiled by special letters from the industrial centers of the United States and is fairly indicative of the general trend of business.

"Continuing increases in the production of iron and steel are reported from important centers," states the report. "This rising tendency is due mainly to two reasons; on one hand, the retarding factors such as the coal and rail strikes, which affected the iron and steel industry several months ago, have largely disappeared and on the other hand the revival of important consuming industries is strengthening the demand so that all that can be produced is called for. In several centers a scarcity of labor is preventing further expansion, and one or two reports indicate that a shortage of raw material is still holding down activity. For the country as a whole, operations are at about 80 per cent of capacity.

The Iron and Steel Consumers

"The railroads, automobile manufacturers and building interests appear to be the leading buyers of iron and steel, while the oil companies, farm implement makers and machine tool manufacturers are among the others who are definitely in the market. The general price level for iron and steel products is about 25 per cent higher than it was a year ago; present prices are firm, with advances frequently noted or expected. Most pig iron quotations range from $28 to $30 per ton, but Southern iron is reported to be about $5 per ton less than that. Because of the increasing demand and the comparatively restricted supply, together with rising production costs, iron and steel prices are expected to go yet higher."

Baldwin Works Show Gain in Profits

While the sales of the Baldwin Locomotive Works were less during the past year than in 1921, the profits were greater due to several outside influences which tended to bring up the value of the common stock. By the recent statement issued from the Works, a yearly dividend of $19.03 was declared whereas in 1921 the dividend amounted to $18.22 a share. This is explained by the fact that the Standard Steel Works, which are controlled by the Baldwin Works paid an extra dividend of $3,000,000 recently and also by the fact that the amount used for taxes, depreciation and deferred profits was smaller in 1922 than in 1921. The detailed statement follows:

	1922	1921
Gross sales	$33,087,258	$49,945,506
Cost of sales	31,092,897	41,832,812
Operating income	$1,994,361	$8,112,694
Other income	6,078,574	2,512,763
Total income	$8,072,935	$10,625,457
Other expenses	1,307,421	.....
Gross profit	$6,765,514	$10,625,457
Reserves, etc.	1,558,995	5,581,361
Net cash profit	$5,206,519	$5,044,096
Preferred dividends	1,400,000	1,400,000
Common dividends	1,400,000	1,400,000
Surplus	$2,406,519	$2,244,096

The balance sheet at the close of 1922 showed net current assets of $51,154,050 against net current liabilities of $12,964,818. The figures at the close of 1921 were $48,423,233 and $14,379,061 respectively. The chief items among net current assets at the end of 1922 included: Inventories valued at $10,855,176, accounts receivable $10,497,234; bills receivable, $7,012,870. Republic of Poland bonds, $6,800,000; Rumanian Treasury notes, $1,433,756; Argentine State Railway notes, $6,971,450; Mexican Government Railway notes, $2,908,665; Chinese Government Railway notes, $1,485,000; Republic of Colombia notes, $401,237; miscellaneous securities, $561,983, and cash on hand, $2,216,677. The chief items among current liabilities included: Accounts payable $6,370,582, bills payable of $5,000,000 and depositors' saving fund, $1,594,235. The profit and loss surplus at the end of the year totaled $18,930,777.

Stewart-Warner Shows Good Profit

After making deductions for expenses, depreciation, and federal taxes, the Stewart-Warner Speedometer Co., shows by the annual report, net profits of $5,335,162. This amount represents an earning of $11.23 on each share of common stock of no par value as compared with $2.19 paid on each share in 1921. The net gain was very marked as compared with the year previous.

Large Sum for Southern Roads

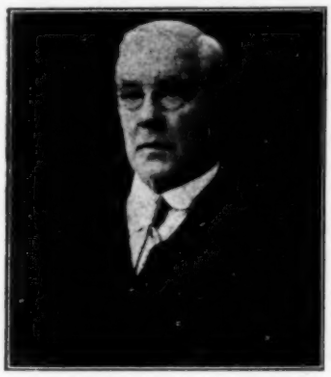
With plans for a connecting highway between states rather than each state building its own separate highway, it is estimated that $400,000,000 will be spent by the southern states during the coming year. This amount is far in excess of anything heretofore spent for roads improvement or construction in the South.

James Mortimer Carpenter Dies in Florida

James Mortimer Carpenter, president and treasurer of the Carpenter Tap & Die Co., Pawtucket, R. I., died at his winter home, St. Petersburg, Fla., Jan. 24, 1923, after a very brief illness of pneumonia.

Mr. Carpenter was born in Cumberland, R. I., a few miles out of Pawtucket, March 28, 1838, and, with the exception of a brief period following the Civil War, has always made his home in or near the city in which his business is now located.

His early education was obtained in the local schools, and while still a boy he entered one of the Pawtucket factories as an apprentice at the machine trade. During the Civil War he was employed as a tool maker and machinist at the Burnside Rifle Works in Providence, where he designed and made



JAMES M. CARPENTER

what is said to have been the first "gun" tap; a tool that has often been re-invented in later years.

The end of the war brought about the closing of the Rifle Works, and after a short period of employment with Brown & Sharpe, Mr. Carpenter embarked upon a sailing vessel bound for San Francisco via Cape Horn. The climate of the West did not suit his New England constitution, however, and about a year later he returned to his native State of Rhode Island.

His first business venture was in connection with the Florence Sewing Machine, Florence, Mass. This venture was unsuccessful but his experience with the firm turned his attention to taps and dies, which in those days were very crude tools, indeed, and made for the most part by the individual mechanics who desired to use them.

In company with David G. Littlefield, Mr. Carpenter established in Pawtucket a small shop for the manufacture of taps and dies. This business with which he has been continuously identified since its inception in 1870 was the nucleus of the present Carpenter Tap & Die Mfg. Co., incorporated under that name in 1891.

Mr. Carpenter was a true exponent of the old fashioned type of New England mechanic, and in his long association with the making of taps and dies has invented, and in some cases personally constructed, many of the machines used in their manufacture. He was also the designer of the first machines for making the gimlet point on coach screws.

Though almost 85 years old, Mr. Carpenter was actively connected with the business up to the time of his death. Notwithstanding his advanced years, which prevented him from spending much time at the factory, he was a frequent visitor at the plant, and in fact spent a part of the day of Dec. 8 at his office, leaving the next day for Florida.

He was for many years a member of the American Society of Mechanical Engineers, and devoted a considerable amount of time and effort toward the standardization of screw threads as a part of his work on the Standardization Committee of that organization. He was for 60 years a member of Mt. Vernon Lodge of Masons in Providence. He was also for many years prominently connected with the Business Men's Association of Pawtucket.

Mr. Carpenter is survived by his wife and one son, Edward M. of Scott, Pa.

Westinghouse Veterans Hold Annual Dinner

The Westinghouse Veterans Association recently held its annual banquet in Pittsburgh, Pa., and was addressed by General Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Co. J. J. Jackson, general attorney for the Westinghouse Co., acted as toastmaster, and besides many interesting speakers, entertainment was also enjoyed.

Other speakers besides Gen. Tripp were E. M. Herr, president of the company, the Rev. C. Wallace Petty of Pittsburgh, and General James G. Harboard, recently elected president of the Radio Corporation of America.

Officers for the ensuing year were elected as follows: president, P. E. Henninger; vice president, F. D. Kennedy; Treasurer, E. W. Davis; and secretary, C. Hayes Long. G. H. Blackmore was elected a trustee.

A. S. T. M. Plans Annual Meeting

The twenty-sixth annual meeting of the American Society for Testing Materials will be held at the Chalfonte-Haddon Hall, Atlantic City, N. J., during the week of June 25 and will close either Friday evening or Saturday morning. Many important subjects will be discussed at this meeting and it is expected that the attendance will be the largest in the history of the society. The Committee on Papers has begun work and it is reported that a number of excellent topics are being developed. The discussion of the last annual meeting, "The Fatigue of Metals" will be continued at this meeting and plans are underway for a discussion of the qualities of concrete.

Locomotive Business is Excellent

At the end of January, the number of unfilled orders on the books of the locomotive companies of this country was the largest that it has ever been. At the present time there are 1,788 locomotives on the books of the companies. During December the shipment of locomotives both to foreign ports and domestic destinations was the heaviest in the history of the industry.

Midvale Reports Smaller Deficit

By the recently issued report for the fourth quarter of 1922 by the Midvale Steel Corp., a deficit of $274,211 for the quarter is shown and a deficit of $3,623,013 for the year is set down. Much of this is charged to the estimated loss caused by the dissolution of the Consolidated Steel Corporation which was the export company. Following is the quarterly report:

	1922	1921
*Net earnings	$2,090,356	$828,358
Interest	730,063	744,848
Deprec. & depl.	1,364,504	1,463,292
Deficit	4,211	1,379,782
Cons. Steel loss	†270,000	
Total deficit	274,211	1,379,782

The income account for 1922, compiled from quarterly reports, compares as follows (subject to adjustment):

	1922	1921
*Net earnings	$3,907,621	$2,860,177
Interest	2,941,746	3,005,622
Depreciation and depletion	4,318,888	5,168,068
Deficit	3,353,013	5,313,513
Construction Steel loss	†270,000	
Total deficit	3,623,013	5,313,513

* After all taxes. † Estimated loss in dissolution of Consolidated Steel Corporation (export company.)

Report of International Nickel Company

By the report of the International Nickel Co., New York, for the nine months ending December, 1922, earnings of $696,959 are shown as compared with $143,714 earned during the same period in 1921. After reductions a balance of $17,937 is left for dividend payment which amounts to twenty cents a share on the preferred stock. In the last nine months of 1921 a deficit was shown which amounted to $641,678.

The balance as of Dec. 31, 1922, shows a profit and loss surplus of $9,632,710 against $10,843,432 at the close of 1921. Cash holdings were $982,803 against $848,802, while accounts and bills receivable were $1,492,059 against $949,205. Inventory was valued at $6,762,512 against $11,011,205. Accounts payable, including reserves for taxes, totaled $442,5522 against $1,122,977.

Buys Much Machinery in 1922

During the year 1922, more than $20,000,000 was spent for new machinery by Massachusetts manufacturers, according to a statement just issued by the Associated Industries of Massachusetts, following a survey which has been made. During the year and as a result of these expenditures 11,377 additional workers were employed.

India Reports Activity

General business is more active and the future is viewed with more optimism in India, according to United States Consul General A. W. Weddell in a recent report to the Department of Commerce, although, he states the bank rate has been increased to eight per cent. December exports exceeded the imports and the exports for 1922 were far in excess of those of 1921. The country is rapidly progressing, according to the statement, and the total amount of foreign trade during the past year is estimated at 4,785,556,000 rupees.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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St. Louis, Mo.

THE RISING tide of business confidence and activity that one meets going West is most impressive. It is seemingly unconscious of Europe and its complications. They are rarely mentioned here and are discussed only as abstractions that are interesting historically but without practical bearing upon American affairs.

The labor shortage, with its implication of higher wages, and the shortage of steel, which may check the building and construction that has been planned for the spring, are the things most talked of as repressive factors, but they are not seriously regarded, as it is generally believed that the prosperity in sight will yield profits so large that high prices will not retard its coming or check its progress. Even the railroad congestion which is great has not dampened the prevailing optimism although it is bitterly complained of in the newspapers.

There is, of course, an element of danger in such widespread and incautious confidence but with money as easy and credit as abundant as at present, there is nothing to chill it visible and it seems likely to continue unless it should become more difficult to borrow or something happens to the crops.

In St. Louis which is the great jobbing market for Texas and the Southwest, the demand for staples as well as luxuries is exceptionally active just now because it is assumed that the timely spring rains which have just fallen in the Gulf States assure a favorable planting season and the probability of a good harvest. The result is that merchants are buying liberally and the shoe trade in particular is said to be the largest on record.

There is also a gratifying improvement in the demand for agricultural implements and in Birmingham, Ala., I was told that a great many cotton gins were being sold for erection in northwest Texas and Oklahoma, in which localities the acreage in cotton will be largely increased because of the supposed immunity from the boll weevil secured by the cold winter weather. An intention to plant more cotton is also manifested in southeastern Missouri and one gin has even been established in southern Illinois.

To these facts briefly cited as evidence of the confidence in good times that prevails, there may be added the statement that including a bond issue of $88,000,000 just voted by the city of St. Louis for municipal improvements, a total of $188,000,000 in bonds will shortly be issued by the State of Missouri or its cities or countries. This includes soldier bonus bonds and bonds whose proceeds will be spent in road building or other public works.

This sort of thing is going on all over the country and though the ultimate result is not pleasant to contemplate, the immediate effect will be inflation. This is a fact that the conservative man cannot ignore however much he may deplore it.

Comptroller Crissinger has again raised the cry that we cannot continue much longer to draw huge quantities of gold to this country, and that we must prepare for an outward movement and for the consequent diminution of our bank reserves. I do not believe that this warning will affect the calculations of many business men as far as the immediate future is concerned, for the confidence of all whom I meet is too pervasive. It is hardly likely that our exports will decline, or our imports increase enough to lesson materially our favorable balance of trade. It is equally unlikely that the heavy annual balance due us as interest on foreign securities held here will be greatly decreased.

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Furthermore, we are no longer absorbing such immense quantities of foreign securities in payment of these balances, nor are we financing Germany by the purchase of her marks as eagerly as we were a year or more ago. And Great Britain has guaranteed payment of her war debt which must be made either in goods or gold.

The possibility of any immediate decrease of our gold holdings therefore seems remote and if we are to undergo any contraction of our credit surplus this year it is more likely to result from expanding demand than from any reduction in its gold base. The Federal Reserve statement last week illustrated this point perfectly. It showed a gain of $2,000,000 in gold reserves, but increases of $26,000,000 in note circulation and of $84,000,000, in bills discounted caused a reduction in the reserve ratio from 77 to 75.3 per cent. But this figure of course indicates an abundance of credit and there will have to be a very much greater expansion in the demand for funds before any tightening of rates, or any check from that quarter to advancing prices, is to be expected.

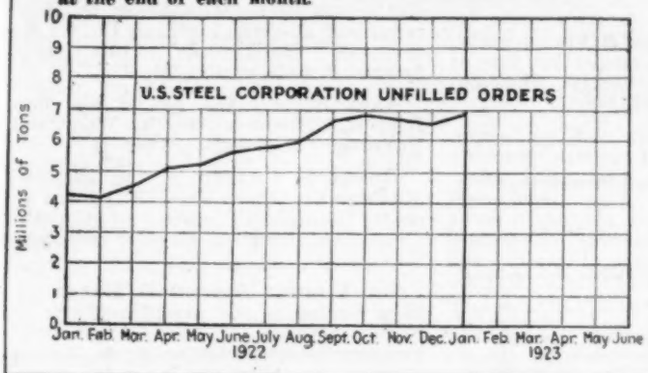
Nor is it possible to discern any threat of an immediate check to the march of prices and business activity from any other quarter. The combination of a labor shortage and advancing prices is bound to produce higher wages, but higher wages and steady employment themselves increase purchasing power so that necessary price advances can be absorbed. In this respect we are in the same position in which the vicious circle of prices and wages was generated during the post-war period. Its ultimate dangers must be recognized, but it causes no pain while it is whirling. The spread between the prices of farm products and the goods the farmers buy has also diminished somewhat and trade reports from the farming districts indicate that distributors expect a good business year.

The threat of railway congestion is one which in this country constantly confronts an incipient boom; and the reports of car shortage from various sections at this time of the year are significant and discouraging. The roads, however, have been purchasing new equipment in greater volume than for several years past and the country's transportation capacity has been augmented by the expansion in intercoastal steamship traffic and the great increase in the use of motor trucks.

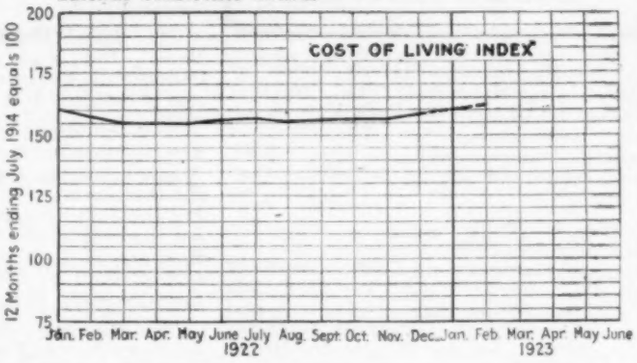
Both security and commodity markets in this country have shown continued indifference to the course of foreign affairs. Neither the possibility of fresh trouble in the Near East nor even of the withdrawal of British troops from Germany caused more than slight irregularity and advances were recorded in nearly all markets. Sugar futures underwent a series of sensational fluctuations which completely blocked all business in raw and refined sugars. Because of the possibility of a scarcity later in the year, the markets have been in an extremely nervous state and when the Department of Commerce issued a statement that consumption this year would be 725,000 tons greater than production and the estimate of the Cuban yield by a leading authority was concurrently reduced to 3,800,000 tons, the rush to "get in" on the market sent prices up nearly 200 points in two days, at which height profit taking and selling prompted by sober second thought quickly drove them down nearly as much. The facts of the situation are that the world's stocks of sugar will undoubtedly be cut into by this year's consumption but the profitable price which sugar is bringing will stimulate production of beets this summer and the probability of an actual shortage is remote. It is extremely difficult to determine the statistical position of sugar very far in advance because its production is spread among virtually all countries and all seasons of the year, and the Department of Commerce is being widely criticised for broadcasting a statement which might well foster an artificial famine.

Among other commodities petroleum and copper have been conspicuously strong.

Unfilled orders of U. S. Steel Corporation based on the monthly reports showing the forward tonnage on the books at the end of each month.



Index of the Cost of Living based on weighted retail prices collected monthly and compiled by the National Industrial Conference Board.



UNFILLED ORDERS on the books of the United States Steel Corporation on January 31 amounted to 6,910,776 tons, which is an increase of 165,073 tons over those of December and a decided increase as compared with the figures of January, 1922, when the tonnage was placed at 2,421,678. All figures which have been issued so far show that the steel industry is in unusually excellent shape and that a season of prosperity is directly ahead in the iron and steel business. It will be noted by the curve of the accompanying chart that during December and November declines in unfilled orders were noted and that a comparison of a year ago shows the rapid strides that have been made in the industry in twelve months.

There are fewer freight cars in the classification of surplus this week, but the difference is not great and the figures show but little change during the past four weeks. Next month, however, it is expected that a big drop in the number of surplus cars will be shown as the demand for cars has greatly increased in January and also more cars are being repaired and put into workable condition. The curve shows that the shortage of cars has slightly increased, this being caused by industrial activity in certain parts of the country. The bad order cars again shows a decrease in numbers and much new equipment has been ordered.

Cost of Living Index this month shows a slight increase over the preceding months although the gain is of such small proportions that there is no cause for worry. Economists have recently stated that with increased prosperity in this country, prices would probably be increased, that there would be demands during the next few months for increases in wages and that, unless we were careful, the disastrous experience of two years ago would be repeated and that merchants would once more experience a buyers' strike and its devastating results. It is the general business opinion that manufacturers and merchants alike have learned the lesson and that prices and conditions will be kept well in hand during this era of prosperity.

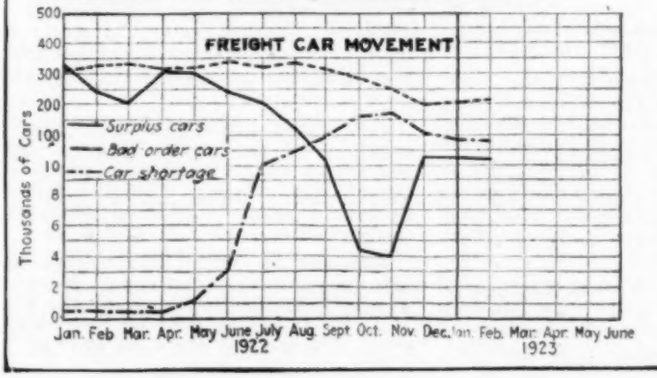
Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

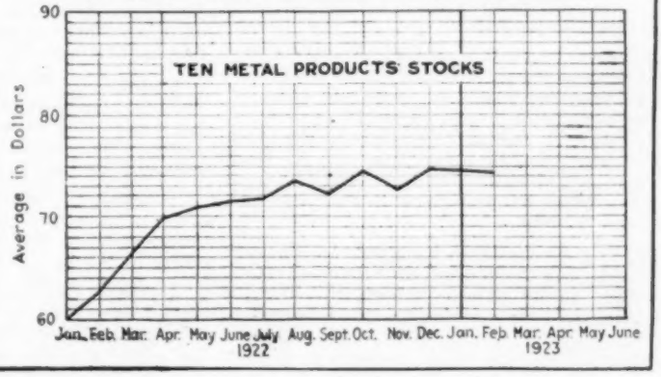
	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb.....	$0.0303	$0.0296	$0.0247
Cold finished shafting.....	per lb.....	0.0397	0.0378	0.0336
Brass rods.....	per lb.....	0.1804	0.1742	0.155
Solder (½ and ½)	per lb.....	0.2617	0.2425	0.2050
Cotton waste..	per lb.....	0.1181	0.1175	0.106
Washers, cast iron (⅛ in.)...	per 100 lb.	4.33	4.33	3.83
Emery, disks, cloth, No. 1, 6 in. dia.....	per 100.....	2.96	2.96	3.11
Lard cutting oil	per gal.....	0.5575	0.5583	0.57
Machine oil....	per gal.....	0.349	0.36	0.40
Belting, leather, medium.....	off list.....	49%	49%	46%
Machine bolts up to 1 x 30 in.	off list.....	51⅓%	51⅓	64⅔%

Metal Products Stocks remain at an even level with but a slight dip shown on the chart this month. The decline is so slight that no explanation is necessary and it is obvious that it is merely a seasonal trouble rather than an industrial ill. Statements from metal product corporations as well as from nearly all corporations this year show that gains have been made in the last twelve months and in many cases substantial increases are shown where deficits were recorded last year. Iron and steel, railroads and machine tools are all reported to be in a healthier condition than for some time past. There seems to be more disposition on the part of investors to deal in industrial and railroad stocks than ever before, some of the smaller roads having had excellent stock sales records during the past few weeks.

Monthly average of car shortage surplus and bad order cars in the United States based on returns to the car service division of the American Railway Association.



Monthly average: Ad. Rumely; Allis-Chalmers; American Can; Cont. Can; Gen. Elec.; Int. Harv.; Nat. Acme; Und. Type.; West. Elec. & Mfg. Co.; Worth. Pump.



Business Items

The Harrisburg Manufacturing & Boiler Co., Harrisburg, Pa., recently opened an office in the Park Row Building, New York City. The company builds boilers, tanks, steel stacks, breechings and special structural steel jobs.

The Marbelide Corp. of America, Los Angeles, Calif., has taken over the plant of the American Cement Products Co., Los Angeles, Calif. The Marbelide Corp. makes concrete electroliers and poles on a large scale. It is incorporated for a million dollars and Henry Barkschat is the president of the concern.

Operations will be started soon by the Palmer Match Co., Kenmore, Ohio, on the new plant which it is building. The company was organized a year ago by Thomas Palmer, formerly with the Diamond Match Co. The first unit will cost $350,000 when it is finished.

The Towmotor Co. Cleveland, Ohio, has just shipped to Port-Louis, Island of Mauritius, a number of towmotors and 16 six-ton trailers for use in hauling sugar. This order is one of four that the Towmotor Co. has supplied for the same kind of work in Port-Louis.

The International Sales Co., 832-33 Hearst Building, San Francisco, Calif., has been organized to promote the export sales of American products. It is planned to open a central foreign sales office at Shanghai, China.

The Steelcraft Co., has been organized in Marion, Ind., and incorporated under Indiana laws with a capital stock of $50,000 for the purpose of manufacturing machinery. The organizers are: L. M. Wiley, R. R. Wiley, John Matter, Milton Matter and H. M. Serviss.

The Marion Tool Works, Inc., has been organized in Marion, Ind., for the purpose of manufacturing tools. The organizers are: E. B. Leigh, W. H. Mitchell and Edwin F. Leigh.

The Klein Iron Works of Bellevue, Ohio, have elected the following officers: C. P. Klein, president, W. L. Willing, vice president, and A. C. Lingling, secretary and treasurer.

At a recent meeting of the stockholders of the National Pressed Gear Co., the following officers were elected: A. L. Lewis, president and sales manager, Harry W. McQuaid, vice-president and chief engineer, Ernest Strong, vice president and superintendent, Harry Nusbaum, secretary and Frank L. De Corps, treasurer.

At a recent meeting of the Athol (Mass.) Manufacturing Co., Lawrence E. Carpenter retired from the office of vice-president and general manager. Arthur H. Starrett succeeds to the office of vice-president and Spencer A. Reed becomes treasurer and general manager. The office of president is held by Willard G. Nims.

The Moore Drop Forging Co., Springfield, Mass., is to build another enlargement to its establishment, this time a brick and steel structure for heat treating, in connection with its Chicopee plant. It will be of one-story, 76x103 feet dimensions. McClintock & Craig drew the plans and Adams & Ruxton Construction Co. have the contract. Work on the building will start immediately.

The Brazil Machine & Foundry Co., Brazil, Ind., was damaged by fire of undetermined origin recently. The damage is estimated at $25,000.

New buildings and new equipment are planned by the Louisville Machine Manufacturing Co., Louisville, Ohio, for the coming year. At a recent meeting the following were elected to serve on the board of directors: Archibald Rodgers, E. L. Menegay, Vincent Samblanet, Paul F. Loichot, E. A. McCuskey and N. L. Menegay.

The Simmons Machine Tool Corp., Albany, N. Y., was recently incorporated to take over the business of the Simmons Machine Co., of Albany. The capital mentioned in the papers of incorporation is placed at $1,500,000. No changes will be made in the personnel.

Machinery Dealers, Inc., formerly known as the Standard Machinery Co., New Haven, Conn., has purchased the building formerly occupied by the Peck Manufacturing Co., and it will be used as the salesroom for the corporation.

The electrical manufacturing plant in Bloomfield, N. J., known as the Sprague Electric Works of the General Electric Co., will hereafter be known as the Bloomfield plant of the G-E Company.

At the annual meeting of the Hartford Machine Screw Co., Hartford, Conn., the following officers were elected for the coming year: P. B. Gales, chairman of the board of directors; J. F. Doyle, president; F. S. Thompson, vice president; H. W. Beardsley, secretary; B. S. Cornwall, assistant treasurer, and E. W. Ladd, assistant secretary. Mr. Doyle, the newly elected president, is an officer and director of the Western Automatic Machine Screw Co., Elyria, Ohio.

The Down High Speed Drill Works is erecting a new shop at Fleetwood, Pa. It is expected that the shop will be completed and running within a few weeks.

Fire of undetermined origin destroyed a portion of the plant of the Aetna Nut Co., Southington, Conn., recently. The damage is estimated at $75,000.

Personals

E. ALLEN MOORE, president of the Stanley Works, New Britain, Conn., has been promoted to the position of chairman of the executive board, succeeding George P. Hart, resigned.

CLARENCE F. BENNETT has been elected president of the Stanley Works, hardware and small tools, New Britain, Conn. Mr. Bennett has been with the concern for more than thirty years.

ERNEST W. CHRIST, MALCOLM FARMER and J. E. STONE have been made vice-presidents of the Stanley Works, New Britain, Conn.

EDWARD E. FULTON, manufacturer of the Atlas Vise at the Fulton Machine Co. plant, Lowville, N. Y., has opened an office for the agency of machinery and mill supplies.

WILLIAM A. VIALL, secretary of the Brown & Sharpe Manufacturing Co., Providence, R. I., was elected a member of the executive committee of the Narragansett Electric Lighting Co., of the same city. He succeeds the late Colonel Samuel P. Colt, of Bristol, R. I.

ARVA STROUD has moved his office from 327 Broadway to the Woolworth Building, 233 Broadway, N. Y.

HENRY S. CHAFEE, of the Diamond Machine Co., Providence, R. I., was recently elected a trustee of the Old Colony Co-operative Bank, Providence, R. I.

DR. THOMAS STOCKHAM BAKER has been elected to the presidency of Carnegie Institute of Technology, Pittsburgh. He succeeds DR. A. A. HAMERSCHLAG who held the chair for nearly 20 years.

EDWIN L. ANDREW has been appointed assistant to manager of the Department of Publicity of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

CLOYD M. CHAPMAN is now associated with Dwight P. Robinson & Co., Inc., New York, in the capacity of consulting materials engineer.

L. K. BERRY, formerly domestic sales manager of Warner & Swasey, Cleveland, Ohio, has been appointed general sales manager of the Detroit Twist Drill Co., Detroit, Mich.

WILLIAM C. HENDERSON, JR., for fifteen years secretary of the Bilton Machine Co., Bridgeport, Conn., has become secretary and treasurer of the A. G. Leake Co. of the same city.

E. P. KELLEY, formerly day enginehouse foreman at the West Springfield, Mass., enginehouse of the Boston & Albany Railroad, has become general enginehouse foreman as the result of the retirement of A. L. BABCOCK on pension.

W. H. DIBBLE, assistant day enginehouse foreman at the West Springfield, Mass., enginehouse of the Boston & Albany Railroad, has been promoted to day enginehouse foreman.

C. R. MCDONALD, formerly in charge of the machinery and foundry equipment purchases of the International Harvester Co., Chicago, has been named assistant works manager of the Milwaukee Works, the Tractor Works, and the Springfield Works, Springfield, Ohio. J. S. NICHOLSON has been promoted to succeed Mr. McDonald.

LOWRY F. SLATER has been elected president of the Ohio State Elevator and Machine Co., Columbus, Ohio. He succeeds the late J. H. DeVere. Mrs. J. H. DeVere becomes vice-president, A. H. Thomas, secretary, and H. R. Burton, treasurer and general manager. The company makes elevators and devices for elevators.

PERCIVAL CHRYSTIE has been elected president of the Taylor-Wharton Iron and Steel Co., Philadelphia, and its subsidiaries including the Philadelphia Roll and Machine Co., Philadelphia, succeeding Knox Taylor, deceased.

HOWARD L. NORRIS has become the sole owner of the Grimes Machine Shops, Bluffton, Ind., through the purchase of the stock held by Mrs. Auric Grimes, widow of the late George W Grimes, and her children.

T. J. CLARY has been appointed southern agent for the Combustion Engineering Corp., New York, with his headquarters at Atlanta, Ga. His office is located at Room 702, Candler Building.

W. J. CORBETT has been engaged as Industrial Engineer for the Electric Steel Founders' research group. His headquarters will be in Chicago, at 639 Diversey Parkway.

WILLIAM BLAKE PATTERSON, president of the Patterson Tool Supply Co., Dayton, Ohio, who has been in Europe for the past three years, has returned to his desk.

Obituary

WILLIAM PENN WORTH, aged 67 years, died recently at his home, Philadelphia, Pa. Mr. Worth was widely known as a steel and iron manufacturer.

R. S. RANSOM, aged 32 years, president of the Ransom Engineering Co., Hazelton, Pa., was accidentally killed January 19, while cleaning his revolver.

GEORGE A. DRAPER, president of the Draper Corp., textile machinery, died recently at his home in Boston.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Engineering tools and small machinery and mechanical goods. Australia. Agencies. Quotations, c.i.f. port of New South Wales. Terms: Cash against documents. Reference No. 5344.

Self-contained gasoline motor-operated electric plant for ranch house, to supply current for lights and refrigerator. Mexico. Purchase. Quotations, c.i.f. Acapulco. Terms: Cash against documents and deposit with order. Reference No. 5349.

Inventions of all sorts, patented devices and specialty goods. Sweden. Agency. Reference No. 5355.

Wood-carving machinery for making ornamental work on picture frame moldings. India. Purchase. Quotations, c.i.f. Calcutta. Terms: Cash. Reference No. 5359.

Wire for winding dynamos, and apparatus for measuring electric current. Poland. Purchase and agency. Quotations, c.i.f. Danzig. Reference No. 5362.

Machinery of every description. Poland. Agency. Quotation, c.i.f. Danzig. Reference No. 5374.

Engineers' supplies such as tools of trade, machine tools and household hardware. Australia. Agency. Quotations, f.o.b. American port. Reference No. 5381.

Oil engine generator set, 10 to 12 kw. to operate on fuel or Diesel oil. Mexico. Purchase. Quotations, c.i.f. Mexican port. Terms: Payment against documents. Correspondence, Spanish. Reference No. 5382.

Engineering lines of any kind, except electrical. Ceylon. Agency. Reference No. 5386.

Industrial machinery, agricultural machinery and automobiles. France. Agency. Reference No. 5387.

Tools, small machinery (grinders, lathes, drills) and technical rubber goods. Netherlands. Sole agency. Quotations, c.i.f. Netherlands port. Terms: Cash against documents. Reference No. 5395.

Medium sized manufacturing unit for making wooden safety matches, the chemical products required. Haiti. Purchase. Quotations, c.i.f. Haitian port. Correspondence, French. Reference No. 5396.

Catalogs Wanted

Randle & Co., Wardha, C. P. India, wishes catalogs of up-to-date machinery for an iron and brass foundry.

Book Reviews

Report of the Lathe Tools Research Committee, Manchester Association of Engineers. 89 pages, 5½x8½ in. in paper covers. Illustrated with charts and line drawings. Published by His Majesty's Stationery Office, Imperial House, Kingsway, London, W. C. 2. Price 5s. 2d.

The report of the Lathe Tools Research Committee of the Manchester Association of Engineers is full of meat and mostly good, fresh meat, too. It describes a number of experiments along eminently practical lines and should be read by all who are interested in the art of cutting metals. That the report does not cover everything in this large field is not a matter for reproach.

This report makes one wonder why England takes the study of cutting tools and their action so much more seriously than these United States. Is it because we think we know it, or because we believe it is not worth knowing? Whatever may be the answer, this much is sure; that England will be ahead of us in machine shop practice unless we go after fundamental knowledge as the Manchester Engineers do.

Handbook of Automobiles. Two hundred forty-nine 5x7 in. pages, paper covers, illustrated. Published by the National Automobile Chamber of Commerce. Price $0.50.

This volume is the twentieth annual handbook. It contains the principal specifications of 154 passenger automobiles, 69 commercial cars and trucks and six electric vehicles produced by leading manufacturers who are members of the National Automobile Chamber of Commerce. At least one type of each make of vehicle is given and in many cases the prices prevailing at the time of publication are listed.

Engineering Economics. By Charles Lounsbury Fish. Three hundred 6x9 in. pages, cloth boards. Second edition, first impression. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $3.00.

A book showing that a knowledge of the business side of engineering, which is engineering economics, is of great importance in the professional success of the engineer.

The subject divisions are: Analysis of problem of investment; interest; preliminary analysis of first cost and of operation cost; practical analysis of first cost; business units; irreducible data of problem of investment; business statistics; miscellaneous forecasts; valuation; errors in estimating; engineering reports. There are several appendices giving specimen papers; tables of formulas and of values; bibliography; questions and problems.

There is taken up in the first part of the book the analysis of the investment problem, as concerns reducible data (from which, yield or profit can be calculated); and irreducible data (which cannot be incorporated in the calculations). The calculation of yield or profit is explained, the principles of compound interest and sinking funds are treated; estimating is taken up; and other subjects such as business units, first principles of financial statements, and cost keeping and engineering reports are discussed.

For the purpose of giving the engineering student and the practicing engineer both general and detailed insight into the interdependence of engineering and business the book is of great value. To the man engaged in business it should be of almost equal value. The quality is enhanced by the mechanical arrangement. Key words are set in bold-faced type; minor paragraphs are set in smaller type; equations, tables, and figures are designated by the numbers of the sections in which they first appear; the sections in chapter I are numbered 101, 102, 103, etc., those in chapter II are numbered from 201 up, and so on.

The second edition is a complete revision, in fact almost a complete rewriting of the first edition. Much new information is given and the whole is presented from the angle of "choice of investment" rather than "choice of structure."

"Mechanical World" Electrical Pocket Book, 1923. Green clothboard covers, 4x6 in., 390 pages, illustrated. Published by Emmott & Co., Limited, 65 King St., Manchester, England. Price, 1/6 net.

The book is a reference volume and handbook covering the field of electrical engineering. It is intended for use both by those installing and operating equipment and by those designing it. The major part of the volume, or 284 pages, is devoted to notes, rules, tables and data covering the theory and practice of electrical engineering. The front portion of the book is taken up with paid advertisements, data on foreign money, weights and measures, and indexes for both the advertising and the data sections. The rear portion is filled with blank pages to serve as a diary.

The data section begins with definitions of electrical units and terms. It then describes all types of electrical apparatus in some detail. Instructions for installing and maintaining electrical systems are given. The problems of both the power station and the current consumer are covered. Besides motors, rheostats and such apparatus, topics like electric welding and heating are treated. Tables of data are given, such as for powers and roots of numbers and for information commonly used in electrical work.

The book has been revised since the past edition, some sections being added and others being rewritten. In the former class is a section on Power in Alternate Current Circuits, and in the latter one on Electrical Measuring Instruments and another on Plant, Load and Diversity Factors. Changes and additions have been made here and there throughout the volume.

Forthcoming Meetings

Philadelphia A.S.M.E. and **Philadelphia A.I.E.E.** Joint meeting February 27 at the Philadelphia Engineers Club. Afternoon, dinner and evening sessions. Louis H. Kenney, Meetings committee, U. S. Navy Yard, Philadelphia, Pa.

Society of Industrial Engineers, Spring convention at Hotel Gibson, Cincinnati, Ohio, April 18 to 20. Secretary, George C. Dent, 327 South La Salle St., Chicago, Ill.

American Gear Manufacturers' Association. Seventh annual meeting April 19, 20 and 21, Hotel Cleveland, Cleveland, Ohio.

National Foreign Trade Council. Annual meeting at the Grunewald Hotel, New Orleans, La., April 25 to 27, 1923. O. K. Davis, Secretary, 1 Hanover Square, New York City.

American Foundrymen's Association. Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago, is secretary.

American Electro Chemical Society, Semi-annual meeting, Hotel Commodore, New York City, May 3 to 5, 1923. Colin G. Fink, 327 South La Salle St., Chicago, Ill., is secretary.

National Supply and Machinery Dealers' Association; Southern Supply and Machinery Dealers' Association; and the American Supply and Machinery Manufacturers' Association, triple convention, in Cincinnati, Ohio, May 17, 18, 19, 1923. F. D. Mitchell, 1819 Broadway, New York City, is secretary.

American Society for Testing Materials. Annual meeting at Atlantic City, June, 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

American Society of Mechanical Engineers. Spring meeting at Montreal, Can., May 28 to 31. Calvin W. Rice, 29 W. 39th St., New York City.

National Metal Trades Association. Twenty-fifth annual convention to be held at Hotel Astor, New York City, April 18 and 19. L. W. Fischer, secretary.

International Chamber of Commerce. Second general meeting, Rome, March 18 to 24. Julius Barnes, President of the United States Chamber of Commerce will head the American delegation.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Coke and basic pig-iron prices firmer. Absolute minimum on steel bars and structural shapes quoted at $2.15 per 100 lb., Pittsburgh; plates, $2.20. These rates, however, apply on heavy contract tonnages only. Premiums for specified deliveries bring out quotations of $2.25 on shapes and bars, and $2.25@$2.35 on plates. Market on structurals is strong; inquiries indicating an active spring demand. Continued buying of steel for railroad car building, together with increased demand for plates, in oil-storage tank construction, are features of the market.

Pronounced advance in copper; up ⅜c. per lb. in week, due to heavy foreign buying. Tin makes new high record; rose 1⅜c. per lb. since last week. Lead up 10c. per 100 lb.; rise of $1 per ton in zinc. Higher prices in unwrought copper give rise to advances ranging from ⅜c. to 1c. per lb. in fabricated brass and copper, in New York and Cleveland warehouses.

Declines—Southern No. 2 pig iron down 50c. per ton in New York. Shipments of Asiatic antimony ⅜c. per lb. cheaper than week ago.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$28.55
Northern Basic	29.77
Southern Ohio No. 2	29.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	33.44
BIRMINGHAM	
No. 2 Foundry	25.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	30.14
Virginia No. 2	33.17
Basic	28.50
Grey Forge	28.14
CHICAGO	
No. 2 Foundry local	30.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	31.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	28.00
Basic	29.27
Bessemer	29.27

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
Cleveland	5½@6
Cincinnati	4½@6
New York	5.5
Chicago	4@5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50@2.75	4.19	3.65	4.00
No. 12	2.60@2.85	4.24	3.70	4.05
No. 14	2.70@2.95	4.29	3.75	4.10
No. 16	2.90@3.15	4.39	3.85	4.20
Black				
Nos. 17 and 21.	3.35	4.70	4.20	4.70
Nos. 22 and 24.	3.40	4.75	4.25	4.70
Nos. 25 and 26.	3.45	4.80	4.30	4.75
No. 28	3.50	4.90	4.40	4.85

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11.	3.35@3.65	4.90	4.30	4.85
Nos. 12 and 14.	3.45@3.75	5.00	4.40	4.95
Nos. 17 and 21.	3.75@4.05	5.30	4.70	....
Nos. 22 and 24.	3.90@4.20	5.45	4.85	5.40
No. 26	4.05@4.35	5.60	5.10	5.55
No. 28	4.35@4.65	5.90	5.40	5 90

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	BUTT WELD Inches	Iron Black	Galv.
1 to 3	64	52½	¼ to 1¼	30	17
LAP WELD					
2	57	45½	2	23	7
2½ to 6	61	49½	2½ to 4	26	11
7 to 8	58	45½	4½ to 6	28	13
9 to 12	57	44½	7 to 12	26	11
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1¼	62	51½	¼ to 1¼	30	14
2 to 3	63	52½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	55	44½	2	23	9
2½ to 4	59	48½	2½ to 4	29	15
4½ to 6	58	47½	4½ to 6	28	14
7 to 8	54	41½	7 to 8	21	7
9 to 12	48	35½	9 to 12	16	2

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	54%	41%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded.	51%	38%	53½%	40½%	59½%	45½%

Malleable fittings: Classes B and C, banded, from New York stock sell at list less 1%. Cast iron, standard sizes, 29% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.54	4.36	4.30
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.30	5.50
Cold finished shafting or screw	4.05	3.90	3.95
Cold finished flats, squares	4.55	4.40	4.45
Structural shapes (base)	3.29	3.16	3.05
Soft steel bars (base)	3.19	3.06	2.95
Soft steel bar shapes (base)	3.19	3.06	2.95
Soft steel bands (base)	3.99	3.61	3.70
Tank plates (base)	3.29	3.01	3.02½
Bar iron (2.75 at mill)	3.04	2.91	2.92½
Drill rod (from list)	55@60%	40@55%	50%
Electric welding wire:			
½	8.50		12@13
⅛	7.00		11@12
3/32 to ¼	6.75		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			16.12½
Tin, 5-ton lots, New York			42.50
Lead (up to carlots), St. Louis	8.15;	New York,	8.62½
Zinc (up to carlots), St. Louis	7.25;	New York,	7.70

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	25.00	26.00
Antimony (Chinese), ton spot	8.12½	9.00	8.25
Copper sheets, base	23.75	22.50@23.00	23.00
Copper wire (carlots)	17.75	19.25	16.25
Copper bars (carlots)	21.75	24.25	19.50
Copper tubing (carlots)	26.25	26.25	23.00
Brass sheets (carlots)	19.87½	22.00	18.75
Brass tubing (carlots)	24.50	25.00	20.50

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (carlots)	18.12½	20.25	15.75
Brass wire (carlots)	20.37½	22.00	.....
Zinc sheets (casks)	10.25	10.25	.....
Solder (⅛ and ¼), (caselots)	30.50	28.00	20.00
Babbitt metal (83% tin)	42.00	49.25	36.00
Babbitt metal (35% tin)	25.00	18.00	.....
Nickel (ingot and shot), Bayonne, N. J.	29.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	32.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	55
Hot rolled rods, Grade "A" (base)	50
Cold drawn rods, Grade "A" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled rods "E"—low manganese (base)	54
Manganese nickel hot rolled rods "D"—high manganese (base)	57

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	46.00
Hot rolled sheets (base)			45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.50	12.75	12.75
Copper, heavy, and wire	12.25	12.25	12.25
Copper, light, and bottoms	10.50	10.75	11.50
Lead, heavy	5.75	6.00	6.75
Lead, tea	5.25	4.75	5.75
Brass, heavy, yellow	7.00	....	7.75
Brass, heavy, red	9.50	10.25	10.00
Brass, light	6.00	6.00	6.75
No. 1 yellow brass turnings	7.00	7.50	7.75
Zinc	4.50	4.50	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28 112 sheets	23.00	21.00	20.90
"A" Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
	Coke Plates, Bright			
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.00	11.50	14.50
IC,	112 sheets	12.30	11.90	14.80
	Terne Plate			
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	6.00	7.25
IC,	14x20	7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.13	$0.11¼
Cotton waste, colored, per lb.	.07@.12	.10	.08
Wiping cloths, 13¼x13¼, per lb.	.16	32.00 per M	.10
Wiping cloths, 13¼x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.60	2.40	2.65
Roll sulphur, per 100 lb	3.40	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.99	1.06	1.02
White lead, dry or in oil	100 lb. kegs.	New York, 14.25	
Red lead, dry	100 lb. kegs.	New York, 14.25	
Red lead, in oil	100 lb. kegs.	New York, 15.75	
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton	$8.00@8.50	
Coke, prompt foundry, Connellsville	per net ton	9.00@9.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	40%	50-10-5%	50%
1½ and 1¼x3 in. up to 12 in	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	.....	65-5%
Lag screws, coach screws	40%	.....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	.....	55%
Tap bolts, hex. head, list plus	20%	.....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ⅛ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅜ in., per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1⅛ to 1½-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅜ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in *EXTRA*	0.25	.....	0.25
Less than 200 lb *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.297	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	60%	50-10%	40-10%
Second grade	65%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Conn., Bridgeport — Manufacturers' Machine Tool & Supply Co., Inc., 256-260 Middle St., A. A. Johnson, Vice Pres.—one sash clamping machine; one 36 to 42 in. drum sanding machine; one veneer press; one double or triple crank arch press, to take work 45 in. between uprights.

Ill., Chicago—Cruver Mfg. Co., 2456 West Jackson St., (manufacturer of advertising novelties), A. Martin, Purch. Agt. — two kick presses, large size on the order of Excelsior No. 15 or American Can style, opening in bed must be at least 6½ x 9¾ in., throat or jaw must extend back 9 in. from center of bed opening (new or used).

Ill., Chicago — International Harvester Co., 606 South Michigan Ave.—one 26 in. roll lathe.

Ill., Chicago—Stoehr Mchy. Co., 844 North Wells St.—one 26 x 48 in. x 8 or 10 ft. McCabe or any other sliding bed, cap lathe.

Ind., Anderson—Gedge Bros. Iron Roofing Co.—bending machine for bending sled runners.

Ind., Indianapolis—Van Camp Hardware & Iron Co., 401 West Maryland St.—foot power squaring shear for 18 gauge 96 in. sheets.

Ia., Cedar Rapids—C. S. Krause, 210 Security Bldg., (garage) drill press, size suitable for automobile repair work.

Kan., Kingman—I. Scott, (machine shop) —power trip hammer.

Mass., Boston—The city, Schoolhouse Dept., City Hall, T. P. Glynn, Chn.—woodworking and metal working machinery, including lathes, saws, tables, jointers, moulders, etc., for manual training department of proposed high school on Dunbar Ave., Dorchester.

Mass., Boston — Collins Motor Car Co., 1037 Commonwealth Ave., (automobile sales and repair station)—small lathe, bench shear, drill press, hacksaw and miscellaneous small tools.

Mass., Boston—E. L. Dodge, 8 Friend St., (furnace makers and repairs)—sand blast outfit, small punch press and tinsmith's bench shears (used).

Mass., East Boston (Boston P. O.)—Boston Sand & Gravel Co., 300 Condor St.,—machine shop planer and shaper, also tinsmiths shears.

Mass., Medford—The city, City Hall, W. H. Casey, Purch. Agt.—machine tools for manual training department of high school, including one single cylinder surface planer; one band sawing machine, saw and saw guard; one jointing machine; one mortising machine; two lathes, about 18 in. swing and 48 in. between centers.

Mich., Detroit — Clayton Lambert Mfg. Co., Knodell Ave, along tracks of Detroit Terminal R.R.—four 16 in. lathes; one 4 ft. plain radial drill; six 16 in. shapers; one 6 ft. plain radial drill; one 4 ft. Universal radial drill; one 4 ft. sensitive radial drill; one 42 in., one 20 in. and one 16 in. slotter; one 36 in. open side planer; one 48 in. x 10 ft. open side planer with 3 heads; one 60 in. vertical boring machine; one 48 in. horizontal milling machine; one jointer; one planing machine; one saw table; one bandsaw; one cutting-off machine.

Mich., Highland Park (Detroit P. O.)—Ford Motor Co.—one roll lathe.

Mo., Affton—A. Hammert, R. F. D. No. 7, (machine shop)—power punch machine.

Mo., St. Louis—Gallaher Boiler Co., 2136 Walnut St., A. Gallaher, Purch. Agt.—small power drill press.

Mo., Webster (McBaine P. O.)—Webster Auto Repair Co.—power punch press.

N. Y., Belleville—Union Academy, W. K. Mott, Woolworth Bldg., Watertown, Purch. Agt.—machine and woodworking tools for vocational training.

N. Y., Binghamton—P. Goodman, 3 Ferry St., (lamp and radiator repair)—sheet metal shears, power operated.

N. Y., Brooklyn — Sass Mfg. Co., 776 Bergen St., (automobile hardware)—one 18 in. shaper.

N. Y., Buffalo—J. Does, 321 Fox St.—equipment, including 500 gal. gasoline tank and pump for proposed service station at 730 Kensington Ave.

N. Y., Croghan—J. H. Smith, Main St., (machine shop)—small shaper (used), also milling cutters.

N. Y., Gouverneur — C. P. Collins Co., (plumbing, steam fitting and heating)—pipe threader, dies and taps, also power operated sheet metal shears.

N. Y., Lowville—Fowler Hardware, Inc., (plumbing and hardware)—P. S. Fowler, Purch. Agt.—pipe threading machine.

N. Y., New York—Mine & Smelter Supply Co., 42 Bway.—one 150 ton and one 100 ton hydraulic wheel press.

N. Y., New York—J. H. Oberle, 238 East 42nd St., (plumbing)—Toledo power driven pipe threading machine.

N. Y., New York—Savage Arms Corp., 50 Church St., C. A. Calleson, Purch. Agt.—No. 14 Bliss toggle drawing press (used).

N. Y., Ogdensburg — C. E. Castle Co., Greene St., (machine shop and garage), G. E. Madlin, Purch. Agt.—complete machine tool equipment for automobile and marine engine repair.

N. Y., Olean—Clark Bros. Co., (steam engines, etc.)—No. 3 Barretts horizontal bar boring machine (used).

N. Y., Syracuse—The Bd. of Contract & Supply, City Hall—about $8,000 worth of machine tools, including two 6 ft. machine lathes and two woodturning machines for Vocational High School; four machine lathes and one sander for Continuation Schools; speed lathe and circular saw for Central High School; two machine lathes for North High School.

N. Y., Theresa—O. P. Eggleston Co. (machine shop)—vertical post drill and reaming tools.

N. Y., Watertown—Bat-Electric Service Co., 619 State St., (electric battery and machine repair), W. W. Parsons, Purch. Agt.—bench lathe, also small hand tools for battery and magneto repair.

N. Y., Watertown — Campbell Transmission Co., Flower Bldg., (electric contractors)—two 1½ ton chain hoists and one magnet winding lathe.

N. Y., Watertown—F. G. Hall Co., 1418 State St., (electric contractor)—one upright sensitive speed drill.

N. Y., Williamsville—H. Berzey—garage and repair shop equipment, to replace that which was destroyed by fire.

O., Akron—K. B. Ayers, 1795 Malasia Rd. —small back geared screw cutting lathe, 8 to 10 in. swing, individual motor drive preferred but not necessary (used).

O., Cleveland—R. S. Machine School, 2118 Prospect Ave.—one No. 1 or No. 2 milling machine.

O., Columbus—International Derrick & Equipment Co., 186 East Broad St., R. Bloss, Purch. Agt.—one rivet machine to take ⅞ to 1 in. rods, capacity 1 ton per day.

O., Columbus—Mack Motor Truck Corp., 517 North Park St., (truck sales and service station), G. B. Jones, Pres. and Mgr.—one drill press and one grinder.

O., Dayton—R. M. Brown, 229 South Ludlow St.—60 x 66 in. x 20 ft. or larger slab miller; engine lathe, 54 in. swing, 14 ft. between centers.

O., Painesville — E. B. Abbott — 30 in. power squaring shears, small punch press and double crank press.

O., West Lafayette—Jones Metal Products Co., F. E. Jones, Pres. and Mgr.—general line of metal working equipment.

O., Wickliffe—Cleveland Crane & Eng. Co. —one wheel lathe.

Pa., Phila.—Frankford Machine Co., 4099 Frankford Ave., (machinists)—screw machine (used).

Pa., Phila.—Pennsylvania R.R. Co., 17th and Filbert Sts., M. Smith, Purch. Agt.—16 in. lathe, 4 ft. radial drill and 28 in. shaper.

Pa., Phila.—F. C. Roberts, Engr., Rochester Trust Bldg.—quantity of lathes and other metal working machinery.

Pa., Phila.—West Phila. Buick Co., 52nd and Chestnut Sts., (automobile service station)—12 or 14 in. motor driven a.c. screw cutting lathe with Universal chuck, 3 ft. 6 in. centers (used preferred).

Pa., Pittsburgh—Pressed Steel Car Co., Farmers Bldg.—gate shears, axle lathe and car wheel boring mills.

Pa., Sharon—W. J. Woodside, Haywood St. and Spearman Ave.—machinery, tools and equipment for garage and repair shop.

Wis., Fond du Lac—Dunham-McCumber Co., 28 3rd St.—automobile repair machinery and equipment for proposed $45,000 garage.

Wis., Hayward—Dehler Auto Co., W. E. Dehler, Mgr.—automobile repair machinery for proposed garage.

Wis., Milton—F. A. Anderson (machinist) —medium size lathe, shafting and belting.

Wis., Rice Lake—T. H. Field—power machinery and shop equipment for proposed motor factory.

Wis., Sheboygan — Eastern Wisconsin Electric Co., 428 North 8th St.—automobile repair machinery, power machine and 1 ton press.

Wis., Sheboygan—F. Hensel Co., North 7th St. and Center Ave.—1 ton press, power machinery and battery charging equipment for proposed garage.

Wis., West Allis—Burbach Auto Co., P. Burbach, Mgr.—power machinery, 1 ton press and equipment for automobile repairing.

B. C. Cloverdale—W. Lawrence, McLellan Rd.—equipment for proposed garage.

Machinery Wanted

Ala., Bay Minette—R. B. Vail, (newspaper)—stereotype saw and a.c. motor, belting, hangers, pulleys and shafting.

Ala., Birmingham—R. E. Boggs, Jefferson County Bank Bldg., (machinery, etc.) —C. E. 7½ Sullivan mining machine, complete on trucks; two complete rock crushing plants, 400 ton per day each, with boilers, engines, etc.; one ¾ yd. steam shovel on caterpillar tread.

Ala., Calera—J. H. Adams—lime working machinery, including conveying machinery.

Ala., Talladega — Talladega Pipe Co., (manufacturer of cast iron pipe), E. Norman, Supt.—cast iron foundry equipment.

Ark., McRae — Enterprise — power job printing press to perforate while printing.

Colo., Aspen—Belle Marie Mining & Milling Co.—mining machinery.

Conn., Higganum—Frissell Fabric Co.—one Foster winder, suitable for 72 in. skeins of heavy cotton yarn.

Conn., South Coventry — Tracey-Elliot Mills, Inc., D. Elliot, Pres.—additional picking, carding, spinning and warping machines, etc., for woolen mills.

Fla., Miami—C. F. Moffett, 71 East 46th St. — woodworking machinery, including planer, bandsaw, etc.

Fla., Moline—Jacob Lumber Co.—planing mill machinery.

Ga., Flowery Branch—J. B. Liles—lathe for woodworking.

Ill., Charleston—Daily News, C. S. Rardin, Purch. Agt.—complete newspaper equipment, including newspaper press, job press, belting, hangers and cutter.

Ill., Chicago—C. M. Coose, 4261 Bway.—8 page duplex newspaper press.

Ill., Chicago—Goodman Mfg. Co., 48th and Halsted Sts.—one 20 ton and one 25 ton, 51 ft. span, cage-operated crane; two 20 ton, two 25 ton, two 15 ton and two 10 ton, 26 ft. span, floor-operated electric cranes.

Ill., Chicago—Natl. Typewriter Wks., 4256 North Kedzie Ave—one printing press, cutter, type, also numbering machine.

Ill., Chicago—Schmidt, 1249 North Clark St.—hand tools for boiler shop, including roller expanders, cutters, water tube rollers, etc.

Ill., Chicago—Simplex Ticket Co., Inc., 1801 Berenice St., (manufacturer of tickets and job printers)—Kidder slitter and stitching machine.

Ill., Chicago — Wanner Mchy. Co., 716 South Dearborn St., (machinery dealers and shop)—Dunning deckle edge paper machine.

Ill., East St. Louis—Friend Printing Co., 201-3 North 5th St.—proof press and job printing press for power equipment.

Ill., National Stock Yards—Reporter Publishing Co., (newspaper) — matrix rolling machine.

Ind., Auburn—Elkhart Motor Co., (manufacturer of automobiles), W. Dennison, Treas.—machinery, equipment and tools for assembling plant.

Ind., Bourbon—News—metal furnace.

Ind., Terre Haute—H. C. Oelgeschlaeger, 2500 Harding Ave. — one set of tinner's tools.

Ia., Burlington — W. A. Rayburn, 315 Tama Bldg.—glass making machinery.

Ia., Des Moines—J. Williams, 203½ 7th St., (job printer)—30 in. power paper cutter.

Kan., Kansas City—Print Shop, 25 South Boeke St.—14 x 20 in. power job printing press.

Kan., Wichita—H. C. Farley, Hotel Lassen, North Market and 1st Sts.—tools for oil drilling, also set of 5½ in. Ideal oil rig irons.

Kan., Wichita — McCormick-Armstrong Press, Market and Williams Sts.—conveying apparatus, printing press, hangers, pulleys, belting and shafting for proposed 2 story printing plant.

Kan., Wichita — McGuin Publishing Co., 410 East Williams St., (job printers and type setters), M. McGuin, Purch. Agt.—Ludlow typecasting machine.

Ky., Maysville—W. H. Mackoy—limestone crusher.

La., Baton Rouge—Print Shop, Box 172—linotype, intertype, monotype, caster, cylinder press, job press, power cutter and stitcher.

Md., Baltimore—J. L. Barr, 224 St. Paul Pl.—one or two 50 ton refrigerating machines, belt or motor driven, also (used) condenser for 100 ton capacity ice making receivers, etc.

Mass., Boston — Edson Mfg. Co., 257 Atlantic Ave., (gears)—$8,000 or $10,000 worth of equipment.

Mass., Boston—Pacific Mills, 101 Milk St.—looms and spindles for new cotton mill in South Carolina.

Mass., Briggsville (North Adams P. O.)—Strong-Hewat Co., address company Purch. Agt.—additional picking, carding, spinning and warping machines for addition to woolen mill.

Mass., Brighton (Boston P. O.)—New England Spun Silk Co., 342 Western Ave., (silk and woolen mills)—additional finishing machines.

Mass., Cambridge—Dixon & Fallis, 1 Dock St., (manufacturers of pattern models), A. Fallis, Purch. Agt.—circular saw table, bandsaw, resaw and jointer (used).

Mass., Dudley—Stevens Linen Wks.—machinery for new bleachery.

Mass., Holyoke—Germania Mills, Inc.—picking, carding, spinning, warping and finishing machines for addition to woolen mill.

Mass., Springfield—The city, Schoolhouse Dept.—machinery, including saws, saw tables, lathes, etc., for manual training department of proposed high school at West Springfield.

Mich., Ann Arbor — Sults Bros., 426 Thompson St.—one power extractor, 2½ or 3 hp. electric motor.

Mich., Detroit—Dept. Purchases and Supplies, Marquette Bldg., G. J. Finn, Comr. of Purchases and Supplies—one No. 58 Crescent Universal woodworker for Dept. of Street Railways.

Mich., Detroit—D. E. Morand Mchy. Co., 8784 Quincy Ave.—one open side planer with 3 heads, 48 x 48 in. x 12 ft. (used preferred).

Mich., Detroit—Print Shop, 407 Gratiot St.—Babcock press.

Mich., Detroit—Witchell-Sheill Co., 1510 Brooklyn Ave., (manufacturer of boots, outing and athletic footwear), W. J. Perkin, Purch. Agt.—shoe machinery.

Mich., Harbor Springs—Graphic Publishing Co.—newspaper press, job press, also press for printing half tones and registering.

Mich., Highland Park (Detroit P. O.)—Ford Motor Co.—mixer, screens, charging car and bucket elevator for proposed steel sintering plant at River Rouge.

Mich., Iron River—Job Shop, 712 West Adams St.—power paper cutter (used).

Mich., Laingsburg—Press—linotype.

Mich., Rochester—Rochester Era, W. A. Fox, Editor and Publisher—one 6 column cylinder press and one folder.

Minn., Duluth—Bridgeman & Russell Co., 1101 West Michigan St.—$175,000 worth of refrigeration and creamery equipment for proposed plant at Atlantic City, N. J.

Minn., Minneapolis—E. W. Peterson, 1721 La Salle Ave.—newspaper press, job press and other equipment (used).

Minn., Winona—Westlicher Herold Publishing Co., (newspaper)—linotype.

Miss., Jackson—Daily Clarion-Ledger, R. M. Hederman, Purch. Agt.—model 1 L. K. 3 or 5 linotype.

Mo., Center—Herald—electric remelting furnace.

Mo., Eldorado Springs—L. T. Dunaway, (oil producer)—75 gal. agitator, 50 barrel tanks, De Laval oil separator, steam pump and carload of 2 in. pipe.

Mo., Fair Play—E. C. Hadley—job press, newspaper press, hangers, pulleys, belting and linotype (used preferred).

Mo., Kansas City—Artcraft Printing Co., 413 East 15th St.—Chandler & Price job printing press.

Mo., Kansas City—Kansas City Flour Mills Co., Postal Bldg., L. E. Moses, Pres.—flour mill machinery to increase capacity of plant (will purchase in spring).

Mo., Kansas City—J. J. Klepping, 2930 Holmes St., (lumber)—sawmill, belting, pulleys and saws.

Mo., Monroe City—Semi-Weekly News—five or six wheel power automatic numbering machine.

Mo., St. Louis—J. Bayle, 1151 Bway (job printer)—power job press.

Mo., St. Louis—Hesse Envelope & Lithograph Co., 501 North 1st St.—one 7 x 11 Chandler-Price job press and one 15 x 19 in. Amer. high speed press.

Mo., Springfield—G. L. Parker, R. R. 6—linotype, job press, hangers, belting and pulleys for job printing plant.

Mo., Wellston (St. Louis P. O.)—Welding Shop, R. R. 29, Box 117—cutting and welding machine with tanks.

N. Y., Adams—O. D. Greene Lumber Co. (lumber and millwork) — Barnes double surface planer and tenoner.

N. Y., Black River—L. D. Waful Co., North Main St., (bakery)—bread and pastry mixing machinery.

N. Y., Buffalo—Cleveland & Buffalo Coal Co., 1224 Prudential Bldg., M. G. Siener, Pres.—portable conveyor, electrically operated for loading and unloading coal for proposed yard at 60 Marion St.

N. Y., Buffalo—Eaton Bros. Co., 45 North Division St., (stationers and office furniture)—large size Universal press.

N. Y., Buffalo—E. J. Gibson, 230 Masten St.—candy making machinery.

N. Y., Buffalo—J. Gunderman, 99 Northampton St., (job printer)—two linotype and two intertype machines.

N. Y., Buffalo—E. M. Hillman, 1331 Michigan Ave.—1,000 gal. gasoline tank and pump for service station.

N. Y., Buffalo—J. M. Holland, 15 Layer Ave.—24 in. shaving blower, also pipe.

N. Y., Buffalo—Root Truck Tire Service, 62 Genesee St., E. Root, Purch. Agt.—vulcanizing equipment for tire repair building at 522 Ellicott St.

N. Y., Buffalo—W. H. Sells, 523 Cornwall Ave.—machinery for the manufacture of canning machinery.

N. Y., Buffalo—A. E. Spencer Products Corp., 228 Washington St., (manufacturer of toilet articles and supplies)—machinery and equipment, to replace that which was destroyed by fire.

N. Y., Buffalo—T. M. Strong, 2075 Seneca St.—candy making machinery.

N. Y., Carthage—W. F. Gehm—woodworking machinery and equipment.

N. Y., Carthage — J. Whaling Co., 916 State St. (lumber)—heavy duty saw frame, saw and table.

N. Y., Clarence—Buffalo Truck & Tractor Co.—machinery and equipment for addition to plant for the manufacture of trucks and tractors.

N. Y., Dolgeville—Dolgeville Felt Shoe Co., Inc., Faville Ave.—felt dies, cutters and felt presses.

N. Y., Fillmore—Bd. Educ.—vocational equipment for $100,000 school.

N. Y., Jamestown—Acme Worsted Mills, Jones and Gifford Aves.—additional looms, worsted and textile mill machinery.

N. Y., Jamestown—Jamestown Chair Co., 20 Winsor St.—woodworking machinery.

N. Y., Jamestown—New Ice & Coal Co., 148 Buffalo St.—ice manufacturing machinery and equipment for plant on Clinton St.

N. Y., Jamestown—Tordoff & Sons, 12 Harrison St., (plumbing and heating works)—machinery, equipment and tools for new plant.

N. Y., Limerick—B. E. Peck Co., (flour and feed grinding mill, lumber and building material)—mortiser, shafting, hangers, belting and pulleys.

N. Y., Lockport—Blandford Paper Box Co., Clinton St., R. V. Scott, Elmira, Purch. Agt.—dies, cutters and folding machinery for paper box plant.

N. Y., Lowville—G. A. Sealy—woodworking machinery.

N. Y., Ogdensburg—Algonquin Paper Co. Inc., E. L. Strong, Purch. Agt.—smithing forge and blower with electric motor.

N. Y., Ogdensburg — F. J. Francis Co., Inc., (electrical engineers)—oil or electric annealing furnace.

N. Y., Rochester—Vacuum Oil Co., Exch. Bldg.—machinery and equipment for $105,000 addition to oil refinery.

N. Y., Tupper Lake—C. H. Elliot (lumber)—bandsaw and double surface planer.

N. Y., Watertown—W. O. Phillips, 729 Davidson St. — special machinery and equipment for dyeing.

N. Y., Watertown — Watertown Stone Products, Inc., Water St.—one gyratory rock crusher.

N. Y., Webster Crossing—W. G. Johnson—flour and feed mill machinery and equipment.

N. C., Lenoir—Nelson Cotton Mills, J. L. Nelson, Treas.—spindles for proposed 6,000 spindle mill at Whitnel.

N. C., Morganton—Drexell Furniture Co.—woodworking machinery and equipment.

N. C., Raleigh—The North Carolina State College, W. C. Riddick, Pres.—equipment for vegetable oil, textile and furniture manufacturing departments.

N. C., Southern Pines — Dixie Printing Co.—32 in. power paper cutter, job press, wire stitcher, perforating machine and other job printing power equipment.

O., Cleveland — The Commissioner of Purchases & Supplies, City Hall—crane, conveyor and loader for use in handling material at city asphalt plant; also jet ash conveyor and 40 ton ash storage tank.

O., Columbus — Franklin Mill & Lumber Co., 178 North Talmadge St., J. E. Jones, Purch. Agt.—one planer, two saws and possibly other equipment.

O., Columbus — Grumman & Moyer, 286 South Glenwood Ave., (manufacturer of porch swings, boxes, etc.), W. S. Grumman, Purch. Agt.—one power saw and one planing machine.

O., Columbus — Rainbow Tire & Rubber Co., Southern Hotel, C. E. Ross, Pres.—three rubber mills; two crushers, two washers and four vulcanizing machines for plant at Delaware.

O., Newton Falls—Newton Steel Co.—sheet steel mill equipment.

O., Shelby—Shelby Spring Hinge Co., L. D. Malone, Mgr. — shafting, belting and electrical equipment.

O., Warren—General Fire Extinguisher Co.—machinery and equipment for proposed plant.

Okla., Ardmore — Hewitt Refining Co.—equipment, including transmission and conveying machinery, for proposed oil refinery at Wilson.

Okla., Cement — F. E. Forgy—complete newspaper equipment, including press, linotype, pulleys, hangers and metal cutter (used).

Pa., Berwick—Marko Bakery—bakeshop equipment.

Pa., Carnegie—Superior Steel Corp.—one 10 ton crane.

Pa., Franklin—Franklin Steel Wks.—one 10 ton crane, 42 ft. span.

Pa., Hughesville—Shindel Silk Corp., M. R. Rosendale, Mgr.—silk mill machinery and equipment, including looms, etc.

Pa., Meshoppen—Allen Planing Mill—planing mill equipment, including saws, etc., to replace that which was destroyed by fire.

Pa., Norristown—Ballard Knitting Mills, Noble and Washington Sts., (textiles), N. D. Wright, Purch. Agt.—ribbers, sewing machines and latch needle machines for new plant at Pottstown.

Pa., Phila.—Bayuk Bros., 1106 Montgomery Ave., (manufacturer of cigars) — one

blower and one air washer, capacity 10,000 cu.ft. per minute.

Pa., Phila.—C. H. Boley Co., 3726 North Randolph St.—mixing machines, filtering vats, grinders, etc., for addition to plant for the manufacture of chemicals.

Pa., Phila.—T. Kenworthy & Bro., Walnut Lane and Pechin St., (textiles), T. Kenworthy, Purch. Agt.—set of cards, wool spindles, etc., for addition to plant.

Pa., Phila.—Northern Woodworking Co., 1005 South 2nd St., (interior woodwork)—saws, planers, tenoners, cutoffs and cabinet makers' tables.

Pa., Phila.—Sykes Bros., Inc., Hancock and Huntingdon Sts., (carpet wool), D. L. Sykes, Purch. Agt.—additional set of wool cards, wool spindles and accessories.

Pa., Phila.—J. A. Trego, 2139 North Park Ave. (cabinet and woodwork)—bench lathe, wood turning.

Pa., Phila.—Universal Publishing Syndicate, 1512 North 13th St., C. W. Caroll, Pres.—cylinder presses, linotypes, paper cutters and other equipment to enlarge plant.

Pa., Pittsburgh—Amer. Sheet & Tin Plate Co., Frick Bldg., M. S. Dennis, Purch. Agt.—one 200 hp. gear drive.

Pa., Pittsburgh—Dravo Cont. Co., Diamond Natl. Bank—one 15 ton crane, 72 ft. span; one 10 ton double trolley crane.

Pa., Trafford—Bd. Educ.—vocational equipment for $125,000 school.

Pa., Wilkes-Barre—J. S. Wilson, Mgr., Coal Exch. Bldg.—machinery and equipment for steel fabricating plant.

Tex., Dallas—Woodworker, 1114 Apple St.—motor driven wood lathe and jig saw.

Tex., Houston—G. Dixon, Prince Theatre Bldg., (oil producer)—oil drill rig.

Tex., Lewisville—Print shop, Box 75—complete job printing equipment, including press, metal cutter, belting and hangers.

Tex., Paris—J. A. Fulks, (job printer)—24 in. power paper cutter (used).

Tex., San Antonio—A. Marinelli, 416 San Fernando St., (cotton producer)—gin machine and breast stand.

Va., Altavista—Altavista Cotton Mills—several looms and several hundred spindles for proposed mill.

Va., Bumpass — D. W. Boxley — wheat binder.

Va., Denbigh—S. E. Hostetter—power hay baler.

Va., Keysville—J. L. Pearson—lathe for woodworking.

Va., Richmond—W. L. Kirby, 6th and Main Sts.—receiving bids until April 1, for complete machinery and equipment for creamery.

W. Va., Chester—Cord Tire Co.—tire building machinery, capacity 2,400 tires per day.

W. Va., Huntington—Bd. Educ.—equipment for vocational departments of new schools.

W. Va., Lumberport—Radio Glass Co., V. L. Horner, Dir.—mechanical etching machinery and equipment for proposed plant.

W. Va., Renick—J. G. Glendenen—single surfacer or pony planer.

Wis., Appleton—Kurz & Root Mfg. Co., W. W. Root, Mgr.—equipment, including power machinery, for the manufacture of electrical appliances.

Wis., Brandon—The Times—one automatic printing press.

Wis., Columbus—Bettle Products Co.—power and woodworking machinery for proposed incubator factory.

Wis., Fond du Lac—Forest Dairy Co., c/o J. Stuebe, Route No. 8—power churns, power separators and milk testers.

Wis., Fond du Lac—A. R. Wiens Sons Co., 24 3rd St., (manufacturer of wire brushes), G. R. Wiens, Purch. Agt.—wire twisting and cutting machines, any size.

Wis., Gays Mills—Bd. Educ., E. Nelson, Pres.—manual training equipment for proposed high school.

Wis., Green Bay—The Printer, 1130 Main St.—newspaper equipment.

Wis., Madison—M. B. Allison, 315 Beaver Bldg.—refrigerating system, either ammonia or brine and ice machine for proposed apartment building.

Wis., Madison—S. Sinaiko, 1968 Railroad St.—feed grinding and power machinery for proposed mill, to replace that which was destroyed by fire.

Wis., Markesan — River View Canning Co., c/o W. A. Miller—canning machinery, sealers, cookers, fillers, etc., for proposed cannery.

Wis., Milwaukee—Louis Allis Co., 133 Stewart St., (manufacturer of electric motors), J. M. Barr, Purch. Agt.—air compressor, approximately 75 ft. capacity.

Wis., Milwaukee—Bahde Mfg. Co., 2621 Vine St. (machinists), C. Bahde, Purch. Agt.—electric crane, about 30 ft.

Wis., Milwaukee—Banner Oil Co., 16th St. and Fond du Lac Ave., (filling station)—air compressor, about 8 x 10; gasoline storage tanks and pumps.

Wis., Milwaukee—Bd. Educ., 10th and Prairie Sts.—manual training equipment for proposed $400,000 grade school on Franklin St.

Wis., Milwaukee—Excel Mfg. Co., 3402 South Pierce St., (woodwork). L. G. Theurer, Pres.—door clamping machine and cross cut saw, both motor driven.

Wis., Milwaukee—M. R. Hayes, 97 Wisconsin St.—air compressor, gasoline storage tanks and pumps for proposed garage.

Wis., Milwaukee—J. Sobczak, 642 Becher St.—electrically driven shoe repair machinery, including sander, buffer and stitcher.

Wis., Milwaukee—R. E. Stoelting, Comr. of Public Wks., City Hall—one mono-rail crane, about 5 ton capacity.

Wis., Milwaukee—Wisconsin Storage Co., 138 7th St., E. Schilling, Purch. Agt.—portable electric power saw to cut 2 in. lumber.

Wis., Neenah — Valley Paper Mills, 145 Wisconsin Ave. — coal and ash handling equipment.

Wis., Platteville — Farmers Consumers Exch., A. Benedict, Mgr.—ice machine, also cold storage and refrigeration equipment for proposed cold storage plant.

Wis., Port Washington—H. W. Bolens, (manufacturer of gasoline engines, etc.)—japanning ovens, standard size.

Wis., Rhinelander—Bd. Educ., A. Moe, Clk.—manual training equipment for proposed $250,000 high school.

Wis., Rhinelander—Rhinelander Creamery & Produce Co., A. De Munck, Mgr.—creamery machinery, including power churns, testers, separators, etc.

Wis., St. Francis—J. Handle, (carpentry and woodwork)—24 in. planer and 6 in. tenoner.

Wis., Sheboygan—G. C. Gresholdt, 1224 South 8th St., (grocer)—refrigerating system and laundry equipment for store and flat building.

Wis., Sheboygan—McNeil Chair Co., J. McNeil, Pres., South 6th St., R. R. Jahn, Archt., 628 North 8th St., Purch. Agt.—power machinery for proposed chair factory.

Wis., Slinger—Reliance Fdry Co., c/o O. H. Wadequist—furnaces, cupola and pouring ladles.

Wis., Sturgeon Bay—Fruit & Dairy Box Co., J. G. Martin, Pres.—woodworking machinery for proposed box factory.

Wis., Waukesha — White Rock Mineral Springs Co., 1702 White Rock Ave., Cahill & Douglas, Engrs., 217 West Water St., Milwaukee, Purch. Agts.—air compressor, 225 ft. capacity, steam driven.

Ont., Arnprior — J. T. Griffiths — carbonizer, scouring plant and 7 looms for woolen mills at Victoriaville, Que.

Ont., Dresden—C. Morrison—complete equipment for proposed flour mill, capacity 200 bbl. per day.

Ont., Elk Lake — Thesaurus Mine Co., Ltd., J. Nelson, Mgr.—complete plant which will make possible development to depth of 500 ft.

Ont., London—Boss & Brazier, 703 Waterloo St.—complete equipment, including cement mixers, etc., for general contracting business.

Ont., London—H. J. Jones & Sons, Dundas St., East—box making and labeling machinery, to replace that which was destroyed by fire.

Ont., Longueiac—Foley, Welsh & Stewart, Contrs.—complete equipment for proposed pulp mill in Grande Prairie district of Alberta, capacity 5,000 cars of pulp per day.

Ont., Midland—J. A. Stewart—electrically driven machinery for the manufacture of motor cars and trucks.

Ont., Owen Sound—Imperial Oil Co.—tanks and complete equipment for proposed oil and gasoline distributing station.

Ont., Seaforth—F. G. Neel—complete equipment for the manufacture of clothing.

Que., Longueuil—C. Walmsley & Co., of Canada, Ltd.—machinery for plant for the manufacture of pulp and paper machinery.

Metal Working Shops

Calif., Davis—The Pacific Gas & Electric Co., 445 Sutter St., San Francisco, has purchased a 25 acre site and is having plans prepared for the construction of a machine shop, garage and warehouse, here. Private plans.

Calif., San Francisco—The Jewell Steel & Malleable Co., 1375 Potrero Ave., awarded the contract for the construction of a 1 story, 36 x 148 ft. addition to its foundry. Estimated cost $5,000.

Calif., San Francisco—A. C. Knowles, 320 Market St., awarded the contract for the construction of a 1 story, 25 x 80 ft machine shop on Howard St. near 6th St. Estimated cost $5,000.

Ia., Cedar Rapids—The Sieg Constr. Co., 5th and Iowa Sts., Davenport, (heavy hardware and automobile supplies), awarded the contract for the construction of a 2 story, 60 x 140 ft. business building, including garage, on 2nd Ave. between 6th and 7th Sts., here. Estimated cost $75,000. R. Bartlett, Secy. R. Vorkoper, Local Mgr. Noted Jan. 4.

Ky., Louisville—The Louisville Ry. Co., 314 West Jefferson St., is having plans prepared for the construction of car shops on 4th Ave. and A St., to replace those which were recently destroyed by fire. Estimated cost $100,000. D. X. Murphy & Bros., Louisville Trust Bldg., Archts.

Mich., River Rouge (Detroit P. O.)—The Ford Motor Co., Highland Park, will soon award the contract for the construction of a 6 story, 24 x 75 ft. sintering plant, here. Estimated cost $50,000. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Nev., Reno—The Osen Motor Sales Co. is having plans prepared for the construction of a 1 story garage on South Virginia and Moran Sts. Estimated cost $40,000. F. J. DeLongchamps, Gazette Bldg., Archt.

O., Cleveland—The Amer. Stove Co., c/o J. G. Way, Mgr., 4301 Perkins Ave., has had plans prepared for the construction of a 1 story, 80 x 140 ft. factory on East 43rd St. and Perkins Ave. Estimated cost $40,000. Carter-Richards Co., Illuminating Bldg., Archts.

O., Cleveland—The Fisher Bros. Co., 2323 Lakeside Ave., (grocers), will soon award the contract for the construction of a 1 and 2 story, 117 x 120 ft. garage and machine shop on Lakeside Ave. near East 22nd St. Estimated cost $60,000. M. F. Fisher, Pres. W. S. Lougee, Marshall Bldg., Cleveland, Archt. Noted Jan. 11.

O., Cleveland—The Lindsay Wire Weaving Co., 14025 Aspinwall Ave., is receiving bids for the construction of a 2 story, 120 x 200 ft. factory and office building. Estimated cost $100,000. Bohnard & Parsson, 1900 Euclid Ave., Cleveland, Archts.

O., Cleveland—The Parkbrook Co., 4600 Brook Park Rd., (sheet metal), awarded the contract for the construction of a 1 story, 160 x 180 ft. factory. Estimated cost $60,000.

O., Cleveland—The Union Terminal Bus Line Co., c/o J. L. Dease, 500 Erie Bldg., awarded the contract for the construction of a 2 story, 72 x 180 ft. garage and service building on Bolivar Rd. Estimated cost $60,000. Noted Dec. 14.

Wis., Milwaukee—The Lakeside Garage Co., 33 Patton Bldg., plans to build a 5 or 6 story garage on the East Side. Estimated cost $250,000. Engineer or architect not selected.

Wis., Milwaukee—The South Side Malleable Castings Co., 14th and Windlake Aves., awarded the contract for the construction of a 1 story, 180 x 240 ft. annealing plant. Estimated cost $60,000.

Canada—The Canadian Pacific Ry., Windsor St. Sta., Montreal, Que., plans improvements to its repair shops at Weston, Ont.; Reston and Minnedosa, Man.; Regina, Broadview and Neudorf, Sask.; Calgary, Alta. J. M. R. Fairbairn, Ch. Engr.

Ont., Toronto—The City Dairy Co., Ltd., Spadina Crescent, is having plans prepared for the construction of a 1 story garage. Estimated cost $30,000. Gore, Nasmith & Storrie, Confederation Life Bldg., Toronto, Engrs.

Ont., Toronto—The Ford Motor Co. of Canada, 672 Dupont St., awarded the contract for the construction of the first unit of its plant, including a 1 story, 400 x 500 ft. motor assembly building and a 1 story, 50 x 100 ft. power house, estimated cost $400,000. Ultimate cost $1,000,000. Noted Oct. 26.